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DIVISION OF FOREST INFLUENCES

Quarterly Report

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Supervision
General*

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U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

April-June-1952

Quarterly Progress Report
Division of Forest Influences
April-June 1952

Flood Control Surveys

The Cumberland River basin has officially been authorized for a comprehensive investigation by Acting Secretary's Memorandum No. 1315, dated July 23, 1952. The Secretary's representative is George K. Stephenson of the Southern Station. He will maintain headquarters at Nashville, Tenn.

Estimates for 1954 have been submitted to the Department by the FS and SCS.

Despite the severe cut in 1953 appropriations, both agencies are basing their estimates for '54 on the need to complete going surveys--on some of which no work has been done for several years--for undertaking several new surveys in which strong local interest has been manifest, for initiating review reports on certain watersheds on which action programs are now under way, and for continuing investigations in the basins of the A-W-R, New England-New York, Columbia and Colorado.

In June Frank was assigned to accompany the CIO Committee on Regional Development and Conservation on a week's trip over the lower portion of the Missouri Basin. Brandeberry and Gladwin Young also participated, together with several SCS representatives under whose direct sponsorship the trip was taken. The group inspected damage areas in the lower Missouri and Kansas River flood plains. (Some remarkable results have followed the rehabilitation work undertaken on heavily sanded bottoms.) They visited the Blue River Valley and discussed with local people the serious conflict with the Corps of Engineers' authorized Tuttle Creek Dam. At Lincoln representatives of the BR and CE described the Pick-Sloan plan and SCS representatives the Salt-Wahoo Creeks watershed report. The Committee next visited the Salt-Wahoo, Little Nemaha, and Little Sioux to inspect conservation and watershed improvement work. The CIO group, consisting of Anthony Wayne Smith, Chairman, and 8 members from various parts of the country, displayed a quick understanding and keen interest in the Missouri Basin developments. Their questions were very much to the point, and they did not hesitate to express their views in favor of the watershed approach. They repeatedly emphasized their interest in shelterbelts and other forestry activities and urged that these be given full consideration in the plans for developing the Basin's watersheds.

The Boise report has been forwarded to the Department. The Forest Service has concurred in the Rio Grande and Trinity-San Jacinto reports, both of which have gone to the Department. In addition the Department has forwarded Missouri Basin Supplement No. 1 report to Congress. This report includes: Upper South Platte, Five Mile Creek, Osage, Blue and Salt-Wahoo watersheds.

Influences

Increases for influences research in F. Y. 1954 have been submitted to the Department. Emphasis is on western water problems in line with the recommendations of S. D. 98, "Soil and Water Problems and Research Needs of the West."

Ted Colman has recently sent to Washington a draft of Chapter X of his book entitled "Vegetation Treatment Regions of the United States" for review and comment. He has also prepared a colored map showing the major vegetation treatment regions and a rating of their soil-water problems. This map, to be exhibited at the annual meeting of the American Geographic Association, will appear in his book.

General

Following the recommendations of the Inter-Agency Committee on International Water Policy (on which Cook (Sec.), Frank (FS), and Allison (SCS) are representatives), the U. S. delegation to the United Nations presented a resolution specifically recognizing the place of watershed development and management as an integral part of multipurpose water resource planning and action throughout the world. This resolution was approved by the United Nations Economic Council.

Recently off the press is the five volume report of the President's Materials Policy Commission, Resources for Freedom. Report No. 9 in Vol. 5 is headed "Water in U. S. Industry." When available, it should prove worth while reading for the background material it contains. (The report is scheduled for reprinting as a House Document and it is then expected to receive wider distribution.)

We suggest you familiarize yourselves with the purposes and activities of the American Watershed Council, Inc., by requesting their monthly pamphlet entitled "The Watershed" from David J. Cuy, Exec. Vice-President, 203 Transportation Building, Washington, D. C.

Dr. Wilm has been elected Chairman of the SAF Watershed Management Division for '52. Hal is now on an extensive tour of the influences stations to bring himself up to date on research problems and to help shape up future research plans. He has prepared a paper "The Relation of Vegetation to Water Yields in Semi-Arid Areas" for delivery at the International Grasslands Conference at State College, Pennsylvania, in August.

QUARTERLY REPORT, APRIL - JUNE 1952, inclusive

Forest Influences Division
California Forest and Range Experiment Station

1. General

a. Personnel. C. J. Kraebel returned to the Station June 9 after 8 months with the Military Geology Branch, USGS, in the catacombs of Washington. The work in which he participated was written up under the title "The Army's Pet Prophets", by Martin Sommers, in THE SATURDAY EVENING POST for March 24, 1945; more recent information is taboo. Kraebel's first job upon his return is to participate with representatives of the Regional Office, in a field investigation of erosion associated with logging.

b. 1951-52 Rain Season. The current rain season has just about drawn to a close with no precipitation occurring in May and 0.03 inch in June. The total rainfall at Tanbark Flat for the period October-June, inclusive, was 40.51 inches, which is 149 percent of the normal of 27.24 inches as of July 1. Total average rainfall for the whole Experimental Forest was 42.21 inches.

Climatic and hydrologic data indicate 1951-52 to be a good water production year, especially welcome after 4 years of drought. It has been very similar to 1936-37 which was a year of above normal rainfall well distributed throughout the rain season. Both 1936-37 and 1951-52 followed dry periods. The 2 years are compared in the following table based upon climatic records at Tanbark Flat and streamflow from the entire San Dimas Forest.

Year ^{1/}	Rainfall		Temperature		Evaporation ^{3/}		Streamflow	
	Inches	Percent	Season	Departure from mean	Season	Departure	Season	Departure
	---Degrees F---		-----Inches-----					
Term ^{2/}								
mean	27.1	--	52.5	--	30.8	--	4.0	--
1951-52	40.5	149	50.5	-2.5	27.3	-3.5	4/6.5	+2.5
1936-37	43.8	162	50.7	-1.8	28.4	-2.4	7.5	+3.5

1/ October-May inclusive.

2/ Rainfall 23 years, temperature 17 years, evaporation 16 years, streamflow 18 years.

3/ Weather Bureau pan.

4/ Estimated.

Rainfall both years was well in excess of the term mean and was produced in 23 storms in 1936-37 and in 20 storms in 1951-52. Over half of the precipitation in both years came in storms of over 2 inches in size, and there was a less than ordinary number of small storms. Snow was prevalent at elevations above 4,000 feet on the San Dimas Forest both years and reached a depth of 4 feet at times. A dense snow pack was formed early in January of 1937 which persisted into March, owing to the very low temperatures prevailing in December and January. Snow was not quite so well consolidated in 1952. The moderate rainfall rates experienced were comparable in both years. The maximum hourly intensity was 0.65 inch in 1936 and 0.63 inch in 1952. In 1936-37 there were five storms having a maximum rain rate of 0.35 inch per hour or more and of these only two with a rate more than 0.50 inch per hour. In 1951-52 there were seven storms in the over 0.35 inch per hour group and of these three had rates of 0.50 inch per hour or more.

Average temperatures were generally below the 17-year mean during both years. There was considerable cold in December, but the great departure from the mean, amounting to -10.7 degrees in January 1937, could hardly be matched by the departure of -3.9 degrees in January 1952. March and April of 1952 were much colder than in 1937. The prevalence of low temperatures in 1951-52 is reflected in the considerable evaporation departure of -3.5 inches, a fact which should have a favorable effect on water production.

Streamflow has been good. The only high storm flows, which were not excessive, occurred during the 7-inch January storm. Subsequent flows were remarkably clear and are persisting at the present time from all Experimental Forest watersheds excepting the three small watersheds in Fern Canyon. Streamflow for 1951-52, estimated from current records, will be about 6.5 inches depth for the entire Experimental Forest. It will be interesting to know how this estimate holds up, since it compares well with the 7.5 inches of yield in 1936-37.

2. Manuscripts in Preparation

a. "Control of Evaporation from Rain Gages by Oil" by Hamilton and Andrews. This short paper has been written in first draft, and illustrations are being prepared.

b. A work outline for a paper entitled "Additional Information on the Calibration and Installation of Fiberglas Soil-Moisture Units" by J. S. Horton has been prepared and reviewed by the San Dimas Experimental Forest staff. This paper will include the latest refinements of calibration technique and will elaborate on the installation methods developed during the past winter. The information will probably be published as a revision of the "Manual of Instructions for Use of the Fiberglas Soil-Moisture Instrument" by E. A. Colman, which appeared as a C.F.&R.E.S. publication in October 1947 and was revised in April 1950.

c. The manuscript "Development of Vegetation after Fire in the Chamise Chaparral of Southern California" is still in process of review. Some of the sample plots were revisited to bring the succession data up-to-date.

d. Ashby and Hellmers completed the manuscript of "Germination of Grasses at Several Alternations of Temperature."

e. Results of plot studies at the San Joaquin Experimental Range to determine effects of grazing on vegetation, soil, and water in a central California foothill grass type were reviewed by Talbot and Rowe to consider publication of this material. A work outline of the hydrologic phases of the study was completed by Rowe and submitted to the Division of Range Research for expansion to include results of the vegetation phases of the study.

f. "Growth and Development of Chaparral Species under Controlled Temperature and Photoperiod" by W. C. Ashby was written and presented at the meeting of the Pacific Division of the American Association for the Advancement of Science, Corvallis, Oregon.

g. "The Nutritional Status of Three Residual Soils of the San Gabriel Mountains, California" by Henry Hellmers. This paper likewise was written and presented at the A.A.A.S. meeting. Comments concerning both Ashby's and Hellmer's papers were received and will be valuable in the preparation of the material for later publication.

3. Current Research

a. Streamflow. Volumetric checks were made recently of flows as measured through several 90-degree weirs at streamgaging stations on the San Dimas Forest. At stages varying from .288 to .486 foot (.12 to .42 c.f.s.) the maximum observed error was .007 c.f.s. or 1.7 percent based upon the volumetric measurements.

b. Lysimeters. The heavy rains of the past winter added sufficient moisture to the confined lysimeters to produce a perched water table in all the planted tanks. The confined lysimeter maintained without vegetation had insufficient penetration of moisture into the soil to saturate the deeper soil layers. Seepage occurred from all the planted tanks except two planted to chamise and one planted to pine. In these tanks surface runoff was somewhat higher, thus reducing the amount of water entering the soil. The presence of a water table has not damaged the vegetation, as all species look healthy and are growing vigorously.

Fiberglas soil-moisture units are now installed in six confined and two unconfined lysimeters, including the 1948 installations. Seventy-five additional units needed to complete the planned installation in both the confined and unconfined lysimeters have been calibrated and will be placed in the soil in the near future.

In order to check the calibration of the fiberglas units, three series of soil moisture samples have been taken in all lysimeters with units installed.

c. Water Utilization. In connection with the study of the influences of pine, brush, and grass cover on the disposition of precipitation, field installation of fiberglas soil-moisture units has been started in the plots at Tanbark Flat. Two stacks of units have been placed in the ground. Units for four other stacks are ready for installation. All the units for the remaining six stacks have been calibrated.

The establishment of a grass cover has been successful on the four Tanbark plots cleared of brush and sown to grass last spring. The clearing was accomplished by cutting; these plots were not burned. The vegetation density on June 16 was about 65 percent of which over half was sown annual ryegrass (Lolium multiflorum). The open areas were open areas were covered by litter or duff which had been left after the clearing operation. If more of this litter had been removed an even denser stand would probably have developed. Additional opening of the cover was brought about by spraying the sprouting stumps and the large perennial herbs such as wild cucumber (Echinocystis macrocarpa) with 2,4,5-T. More than half of the stumps and almost all of the wild cucumber succumbed to this spray.

d. Ecological Studies. During the period 1937 to 1945, phenological data on shoot and leaf growth and flowering response were collected from a series of plots from 1,500 to 5,300 feet in altitude on the San Dimas Experimental Forest. Many of these plots were located near climatic stations where records of temperature, humidity, and rainfall would be available. Analysis of these data was started recently, as this information is needed in connection with growth studies undertaken at the California Institute of Technology (Refer to Plant Physiology). In the Cal Tech studies different species are grown under temperature controlled conditions and more information is needed on the responses of the native vegetation to temperature and other factors.

e. Soil Moisture Instrument. In order to convert the ohms resistance reading, obtained by a fiberglas unit, to soil moisture percent, it is necessary to correct for temperature. We have found that an alignment chart is the most efficient way of making this correction and we have designed a new chart which is easier to read and therefore more rapid and accurate than any other method so far tested.

f. Plant Physiology.

(1) Nutrition Studies. Greenhouse tests were continued of the growth of native plants in soils derived from the three principal parent materials (Wilson diorite, Lowe granodiorite, and anorthosite) in the Los Angeles River watershed. Ceanothus crassifolius has been harvested. Statistical analysis of the data showed a significant increase in growth with nitrogen on the Wilson diorite and Lowe granodiorite. The addition of phosphorus resulted in a significant response in growth of plants on the Lowe granodiorite.

The native vegetation on the field plots to which nitrogen and phosphorus were applied singly and in combination in 1950 and on those to which three levels of nitrogen were applied in 1951 was sampled. The data are currently being statistically analyzed.

A study of the macro-element deficiency symptoms of native chaparral woody plants was started at the Orlando Greenhouse of the California Institute of Technology. This study has for its objective the determination of any color or morphological characteristics that develop in Pinus coulteri, Pseudotsuga macrocarpa, Ceanothus crassifolius, Adenostoma fasciculatum, Rhus ovata, and Arctostaphylos glandulosa as a result of nitrogen, phosphorus, potassium, calcium, or sulfur deficiency,

(2) Transpiration. A study has been undertaken to determine the effect of the previous temperature history of plants on rates of transpiration at several temperatures. Ceanothus crassifolius was selected as the test plant because (1) it is a species native to the local chaparral areas, and (2) the growth study has shown it to be capable of producing a fairly uniform plant under a wide range of temperatures. Aside from the direct results obtained, this study should also yield information that can be used to evaluate some of the large mass of literature in the field of transpiration.

(3) Growth Studies. Harvesting has been completed for several species being grown under eight conditions of controlled temperature in the Earhart Plant Research Laboratory at the California Institute of Technology (Quarterly Report, October-December, 1951). These plants include: Native or resident in the Los Angeles River watershed--Bromus rigidus, Melica imperfecta, Rhus laurina, Rhus ovata; non-native--Bromus stamineus, Ehrharta calycina, Phalaris tuberosa var. stenoptera, and Cytisus canariensis. Tests are being continued with the non-native species, Baccharis pilularis ssp. typica, Brassica nigra, Dodonaea viscosa var. angustifolia, Lolium multiflorum, and the native, Pinus coulteri. The growth responses of species found in the chaparral zone of the Los Angeles River watershed under the several temperature conditions, together with field data on their growth during the several seasons of the year, are used to evaluate the temperature adaptability required of non-native species recommended for erosion control plantings. Exotic species found adaptable will be tested further for drought resistance

and other characteristics in the San Dimas lysimeters and in field plots. Our endeavors to secure seed of exotic species for testing have been much aided through the efforts of Dr. F. W. Went. He made several personal contacts with workers in Mediterranean areas while at and enroute to the international desert conference held this spring in Israel. Several of these workers are forwarding seed.

A work plan was prepared and activated for the selection of hybrid ceanothus plants for use in the growth studies. The following hybrid seed was furnished by Dr. Nobs of the Carnegie Institute of Washington at Stanford University. F₁ Ceanothus gloriosus X C. cuneatus, F₂ C. gloriosus X C. cuneatus, F₂ C. gloriosus X C. verrucosus. Characteristics of a highly desirable plant would include a prostrate form and the capacity for good growth under southern California environmental conditions.

g. Kings River Branch. Rainfall on the Big Creek watersheds totaled 7.87 inches in March and 3.39 inches in April. No rain was recorded in May or June. The total rainfall for 1951-52 to June 1 was 34.80 inches or about 140 percent of the average. There were no high rainfall rates nor runoff peaks during April and May. The watersheds were covered with a heavy stand of grass in April and it appeared that very few shrubs and trees had been severely damaged by the burn of July 1951.

Preliminary streamflow data for the 1951-52 season from Big Creek watershed No. 4 (21 acres area) showed a yield of 8.63 acre feet for the period October-April, inclusive. This amounts to 4.84 surface inches or 13.9 percent of the seasonal rainfall of 34.79 inches.

In the following table monthly amounts of rainfall and streamflow are presented for 1951-52 and for 1936-37.

Big Creek Watershed No. 4

Month	Rainfall		Streamflow yield	
	1936-37	1951-52	1936-37	1951-52
	Inches		Acre feet	
October	1.03	1.30	0.01	0
November	0	2.89	0.10	0.01
December	8.95	9.28	0.40	0.33
January	4.05	8.19	0.45	1.56
February	10.12	1.87	3.13	0.73
March	6.21	7.87	2.98	3.77
April	1.58	3.39	2.40	2.23
Total	31.94	34.79	9.47	8.63

The hydrologic year 1936-37 was the first one of record for this watershed and at that time the area had not been subjected to the major flood of December 1937. Total rainfall in 1936-37 was about the same as in 1951-52, but a greater portion of it occurred during the fall in 1951 than in 1936 and the distribution pattern in January and February of the two seasons was reversed. Streamflow did not start until November of 1951, whereas it was occurring in October of 1936. The flow from the watershed at the present time is about the same as it was in 1937, and it will be of much interest to determine whether or not streamflow will persist through the summer months as it did at that time.

4. Meetings Attended

April 28 and 29. This year's Station-Region 5 Annual Investigative meeting was attended by Sinclair, Rowe, and Gleason from the Influences Division. The first day of the meeting was devoted to the subject of Brushland Improvement. As part of the discussion of factors affecting the selection of areas for brushland improvement Rowe explained the hydrologic aspects and application of vegetative-soils data, Sinclair talked on runoff and water yield relations, and Gleason discussed the factor of steepness of slope.

May 12. Sinclair attended a meeting of the Conservation Association of Southern California held at Los Angeles. A statement of proposed principles of wild land management in southern California was presented by William V. Mendenhall, chairman of a committee that had previously been designated for this purpose. The statement was submitted to the Association membership for consideration.

May 16. Rowe took part in a panel discussion of brush conversion by burning and other methods at the May meeting of the Southern California Section, Society of American Foresters. Chairman Hamilton turned the gavel over to Chairman-elect Hellmers.

May 26-30. Sinclair, Hamilton, Horton, and Rowe attended the Workman Creek Watershed Conference conducted by the Southwestern Forest and Range Experiment Station at the Sierra Ancha Experimental Forest headquarters. Purpose of the meeting was to review the Workman Creek calibration data and analyze the Station's proposals for experimental treatment of the watersheds. Following the conference, Fletcher and Rich showed the San Dimas group and several who had attended the meeting, other phases of Forest Influences research being carried on in the Sierra Ancha area.

June 9. Sinclair attended a meeting of the Conservation Committee of the Los Angeles Chamber of Commerce held at Los Angeles. A favorable report on the Committee's field trip to the San Dimas Experimental Forest on May 20, was given by E. H. Walters, General Manager of the Covina Irrigating Company and chairman of the group's watershed management subcommittee.

June 16-20. Hellmers and Ashby each presented a paper (Refer to Manuscripts in Preparation) orally at the meetings of the Pacific Division of the American Association for the Advancement of Science held at Corvallis, Oregon.

5. Field Trips

Ashby Visits Southwest. Ashby spent most of the month of April on leave in Arizona, New Mexico, and Texas. He was able to make contacts at the Southwestern Forest and Range Experiment Station, Soil Conservation Service, Boyce Thompson Southwestern Arboretum, and with several interested people from whom he obtained seed and information for use in the program of plant introduction for erosion control in the Los Angeles River watershed.

Cleveland National Forest Tour. Ashby, Hamilton, Hellmers, Horton, Rowe, and Sinclair of the San Dimas staff, and Juhren of the Angeles Forest Flood Control Project, visited the Palomar and Descanso Districts of the Cleveland National Forest guided by Supervisor Pyles and Rangers James and Britton. Regional Engineer Byrne accompanied the group the first day. Principal objectives of the trip were to observe an area of extremely old chaparral on the slopes of Agua Tibia Mountain, the outstanding road-slope stabilization work on Palomar Mountain highway done by San Diego County under Juhren's direction several years ago, the San Diego County fire break being developed on the westerly slopes of the Cuyamaca Mountains, and a demonstration of brushland improvement (conversion to grass) being conducted by State and County agencies and the Cleveland Forest on a chamise-covered area east of El Capitan Reservoir.

6. Cooperation

a. University of California-Station Hydrologic Committee. In response to an invitation from Prof. Veihmeyer, Director Wyckoff, Talbot, Sinclair, and Rowe met on April 22 with Veihmeyer, Burgy, and Sparks from the University at Davis. The purpose of the meeting was to discuss possibilities of joint hydrologic studies at the University's new experimental range near Hopland, California. Two watershed areas at this range have been set aside by the University for hydrologic research. On April 23 the group, excepting Prof. Veihmeyer, visited the range to examine these watershed areas at first hand.

The watersheds selected for the study have been grazed by sheep and cattle since the late sixties. A moderately dense to sparse oak-woodland vegetation is found along the stream in the higher portions of the drainage and on the northerly exposures. Except for a few small patches of chamise the remainder of the area is grassland with scattered oak. The soils are relatively stable, slopes are generally moderate to steep with elevations ranging from about 700 to 1300 feet above sea level. Annual rainfall is believed to average about 35 inches.

The smaller of the two watersheds is about 55 acres in area and drains to the east; the larger watershed, about 160 acres in area, drains to the southwest. Neither watershed appears particularly well suited to studies of the effects of burning, or conversion to grass, upon surface runoff and erosion. They may, however, offer an opportunity to study effects of different intensities of grazing, or thinning or removal of the woodland vegetation, upon water yield. This would call for rather detailed experimentation and calibration of the watersheds and sub-drainage prior to treatment.

On June 11 Sinclair met with Veihmeyer, Burgy, and Sparks at Davis for further discussion of plans and instrumentation. The University group proposes to install several rain gages and streamgaging stations on the watersheds at the Hopland range before next winter. Instruments from the Station will be provided for this purpose.

b. Bureau of Reclamation. Plans and a rating table for a San Dimas flume two feet in width were submitted to the Bureau's office at Fresno in response to a request from C. C. Green. Mr. Green reports that five flumes are to be installed to measure influent seepage from ground-water along an artificial channel built as a wasteway from the Delta-Mendota Canal. The San Dimas flume was selected for this use because the flows carry considerable silt.

c. Conservation Association of Southern California. Sinclair served on a committee under the chairmanship of W. V. Mendenhall in drafting a statement of principles for the management of wildlands in southern California. The statement was presented by Mendenhall at a meeting of the Association on May 12.

d. U. S. Forest Service-Army Infiltration Project, Vicksburg, Miss. Howard Lull visited the San Dimas Branch to review the Station's infiltration and soil moisture studies with Horton and Rowe. Pertinent data were made available to Lull for use in connection with the Vicksburg project.

e. Mendocino County Vegetation-Soils Survey. Prof. Earl Storie of the Soils Department, University of California, spent May 19 with Rowe discussing the application of vegetation-soils data in watershed management. The data considered was collected by the Station-State Cooperative Vegetation-Soils Survey of Mendocino County and will be included in a forthcoming report of this work. Later, Rowe drafted proposed sections for this report concerning the hydrologic significance of the vegetation-soils data.

f. Stanford University. "Small Scale Topographic Effects on Precipitation Distribution in San Dimas Experimental Forest, California," is the title of a thesis submitted by Joseph I. Burns to the Department of Civil Engineering of Stanford University. Using San Dimas basic rainfall data Mr. Burns defined five topographic parameters that influence rainfall distribution within the Forest area and correlated them with mean annual precipitation by the method of multiple coaxial correlation.

g. Division of Water Resources, State of California. San Dimas basic precipitation data have been made available to the Division in connection with a study on the effects of cloud seeding. Analysis of the data will be made by the Statistical Laboratory of the University of California under the direction of Dr. Jerzy Neyman.

h. University of California, Department of Agriculture. The summer practice and observation course in entomology is being conducted this year at the Tanbark Flat headquarters of the San Dimas Experimental Forest. A class of 50 students, under the direction of Dr. J. W. MacSwain, started five weeks of intensive work June 23. This is the second summer that Station facilities at San Dimas have been made available for this purpose.

i. General. Requests for erosion control information took an up-swing after a letter written by C. S. Robinson, Forest Service retiree, appeared in the Los Angeles Times of April 6. The letter pointed out the reasons for so much erosion from hill subdivisions and mentioned the bulletin "Trees and Shrubs for Erosion Control in Southern California Mountains."

7. Visitors

a. San Dimas Branch

April 8. Roy R. Salen, Blue River Experimental Forest, Pacific Northwest Forest and Range Experiment Station.

April 8-12. M. W. Talbot, Associate Director, California Forest and Range Experiment Station, Berkeley.

April 10. Byron B. Beattie, William H. Hansen, and Clifford E. Risbrudt, Sierra National Forest, California.

April 14. J. R. Pelletier, Superintendent of the Agricultural Experiment Station at Quebec, Canada, visited the Plant Physiology Project and the San Dimas Experimental Forest.

April 19-20. Conservation Committee, Post 13, American Legion, Pasadena (12 members).

April 29-May 2. Prof. Joseph Kittredge and Robert Merriam, University of California, Berkeley.

May 6. Dr. Friedrich Ehrendorfer, Ecologist at the University of Vienna, Austria, visited the Plant Physiology studies at the California Institute of Technology.

May 11-12. Prof. Arthur D. Smith and 15 students from the Utah State Agricultural College.

May 12. Dr. N. T. Mirov, California Forest and Range Experiment Station, Berkeley.

May 19. Prof. Earl Storie, Department of Soils, University of California, Berkeley.

May 20. Conservation Committee, Los Angeles Chamber of Commerce. A group of 24 members and guests of the Committee took part in this field trip to the San Dimas Experimental Forest.

May 20-21. Howard Lull, Forest Service Infiltration Project, Vicksburg, Miss. He described the work under way and illustrated his talk with Kodachrome slides.

May 22. Drs. Hull, Links, Yamato, and Fujiwara, Research Fellows at the California Institute of Technology.

June 19-21. Dr. M. A. Gazier, American Museum of Natural History, New York City, N. Y.

8. Personnel

Two temporary employees joined the San Dimas staff: B. W. Heacox on April 21 and Morris G. Cline on June 16. Heacox worked at Tanbark for several weeks on the installation of soil-moisture units before starting the phenological data analysis discussed previously. Cline, a University of California student, will be working for the summer at Tanbark installing fiberglas units and doing other research jobs.

Approximately 900 man-days of assistance from Angeles Forest personnel on detail was used on the San Dimas Experimental Forest during the last eight months. These men aided in the collection of records and in other research activities as well as in the maintenance of facilities,

QUARTERLY REPORT OF FLOOD CONTROL SURVEY ACTIVITIES

California Forest and Range Experiment Station

April 1, 1952 - June 30, 1952

General

The Sierra snow pack as a whole on April 1, 1952, contained a volume of water exceeding any heretofore measured. Seasonal precipitation varied from 200 percent of normal at Sierraville and 175 percent at San Diego to 103 percent at Redbluff. A rough calculation indicates a state average of about 137 percent of normal. Although runoff during April 1 to July 31 from the watershed above Shasta Dam will be less than that of 1948 Shasta Dam filled for the first time and water spilled May 20. On all other major snowfed streams, runoffs during the snow-melt period will probably exceed those of record during the past 35 years or longer.

Due to a cool and fairly dry spring the potentially dangerous flood season was passed without major difficulty. However, there was inundation of low lying areas along many streams. The most important of these were 5,000 acres along the San Joaquin River west of Modesto and 85,000 additional acres in Tulare Lake Basin. It is reported that corporation farmers spent about \$1,000,000 to increase the level of dikes in Tulare Lake Basin, and prevented further spread of floodwaters.

As indicated earlier the runoff from snowfed streams in the Sierra Nevada will be the greatest in years. The runoff forecasts range from 242 percent of the 62-year normal expectancy on the Kern River Basin to 139 percent on the watershed of the Sacramento River above Shasta Dam.

Current Surveys

1. Wrightwood Area.--No change in status.
2. Santa Maria River.--Report is under review by the Bureau of the Budget.
3. San Gabriel-Santa Ana Rivers.--Revision of this report has been completed. Copies of the report will be forwarded to the Washington Office in the near future.
- 4.--Santa Clara-Ventura Rivers and Calleguas Creek.--Revision of this report was completed in May after comments were received from the various reviewing agencies. Recently further comments have been received from the Washington Offices of the Bureau of Agricultural Economics and the Forest Service. When these suggested changes are incorporated in the report it is believed it will be in final form.
5. San Diego County Western Watersheds.--No further action. Status indefinite.
6. Columbia River Basin.--During the quarter reports have been completed for all Willamette River Basin sample areas, eight in number.

The activities of the three functional sections of the Division for the past quarter were as follows:

Land Use Section.--Completed calculation of costs and benefits for the eight sample watersheds in the Willamette. Dellberg and Beeson attended the Land Use Committee meeting May 7-8-9 in Portland. Land use problems in general were considered with most attention being given to methods of calculating range and forest land conservation benefits.

Engineering and Hydrology Section.--Suspended sediment sources and variation of suspended sediment with treatment and land use were evaluated for western Oregon. Measurements of average annual suspended sediment delivery from 29 watersheds were utilized. Variation in the sediment production was found to be associated with:

1. Meteorological differences as indexed by (a) the mean annual runoff in csm and (b) a peak runoff potential variable based on the product of frequency of large storms producing rain and snow melt and the peak runoff potential of the geologic types in the watershed.
2. Topographic differences as they influenced 1-b above and as indexed by (a) the area of the watershed and (b) the slope of the first order streams.
3. The soil erodibility differences as indexed by the physical characteristics of the surface soils of the 24 major geologic types, the physical characteristics being (a) a supply factor which in the case of erosion measured as suspended sediment was taken to be the silt plus clay percentage of the whole soil, (b) a soil binding factor--the amount of surface requiring binding as expressed by the surface area of the soil particles whose diameter was greater than the silt size (0.05mm) divided by the binding characteristic of the soil as indexed by the aggregated silt plus clay (ultimate silt plus clay minus Middleton's suspension percent), and (c) a protective factor, the gravel and rock in the soil (mean diameters of the size groups squared, weighted by the percent of the soil in that size group).
4. The land use and treatment differences as indexed by (a) the amount of bare cultivated area, (b) the amount of other cultivated land, (c) the road area in the watershed, (d) the amount of recent cut-over land, and (e) the length of eroding banks in the main channels.

The analyses have been applied to give a map of the erosion hazard with the forest area segregated into nine classes, with estimated suspended sediment production under present land use being only 5-20 tons per square mile per year in the least erodible class and 500-700 tons per square mile per year in the most erodible class. Since time was not available for analysis of soil erodibility of the agricultural land soils, the erosion hazard of 240 tons per square mile per year was segregated into three classes, based on Soil Conservation Service erosion classes 1, 2, and 3, with assigned erosion of 120, 480, and 840 respectively.

Segregation of total suspended sediment in the Willamette Valley above Salem, Oregon, gave, under present conditions, the following distribution of the 1,955,000 tons per year:

1. Coming from the 5,460 square miles of forest land - 24 percent.
2. Coming from the 1,820 square miles of agricultural land - 22 percent.
3. Coming from the 205,000 feet of eroding main channels - 54 percent.

The present state of the results does not furnish an adequate basis for management decisions, but suggests the following relative priority in studies of management alternatives as they affect suspended sediment production: 1) Eroding bank control, 2) road development methods and precautions, 3) bare cultivation control, 4) cutting practice precautions. The study indicated the possibility that unless improved practices are brought about in the forest land, future sediment delivery from the forest land may be expected to be three times the present with some 80 percent of the increase assignable to road development.

Watershed Appraisal Section.---Maeyers handled the economic analysis of the programs proposed for the sample watersheds in the Willamette. He attended the Economic Committee meetings in Portland April 15-16-17.

Personnel

Mr. D. M. Ilch, Chief of Flood Control Surveys at this Station, left Berkeley on June 28 for his new assignment as assistant to Dr. Harold G. Wilm, Washington, D. C.

Mr. T. G. Storey spent the period March 26 to June 17 on detail to the office of Forest Influences, Washington, D. C. His duties there consisted of (1) reviewing Forest Service and Soil Conservation Service flood-control survey reports under one or more of the various review steps at the Washington level, (2) devising a flood-control report control and record system whereby the present status and past history of any report could be readily determined, (3) representing Influences on the Federal Inter-Agency Subcommittee on Sedimentation and Hydrology, and (4) assisting in other routine work of the Division such as preparation of correspondence and literature searches.



Quarterly Report
of
Flood Control Surveys and Forest Influences Activity
April - June 1952

FLOOD CONTROL SURVEYS

General

We were much interested in Tripp's comment (October-December, 1951 report) concerning offsite benefits. Here in the Central States, where erosion rates are high and sediment damages frequently are greater than inundation damages, erosion damage has been evaluated as a matter of policy. This is particularly true of some watersheds whose streams are subject to reservoir control.

The average annual benefits estimated for the Cuyahoga River Watershed in northern Ohio illustrates this very well. These are listed below:

<u>Type of Benefit</u>	<u>Benefit</u> (dollars)	<u>Benefit</u> (dollars)
Reduction in Erosion Damage		
Sheet Erosion	34,219	
Gully Erosion	377	
Streambank Erosion	270	
Subtotal		34,866
Reduction in Inundation Damage		
Agricultural	190	
Non-Agricultural	310	
Subtotal		500
Reduction in Sediment Damage		
Infertile Overwash	345	
Swamping	522	
Reservoirs and Ponds	14,209	
Industrial Water Supplies	6,160	
Transportation Facilities	13,109	
Drainage Ditches	11,660	
Harbor Sedimentation	69,051	
Subtotal		115,056

Unfortunately, many of our benefit analyses do not consider such benefits as may be due to increased base flow and improved water quality; the recreation and fish and wildlife aspects; and above all the indirect benefits of alleviation of human misery, etc.

The human angle, especially has been verbotten, yet it is real and should be evaluated. During the Missouri River flood of 1952, two residents of a flooded hamlet of 2200 persons became insane and were sent to a state institution. What is the cost of society for taking care of and rehabilitating, if rehabilitation is possible, these two unfortunates? How many more cases of this kind exist, but are not recorded?

Survey Status

As no new surveys were commenced during the quarter, survey activity was confined to completing reports and facilitating report reviews. The status of individual surveys all under Soil Conservation Service responsibility, is described below.

Cuyahoga River (Ohio)

Forest Service review is completed and the report is being revised by SCS.

David's Creek (Iowa)

The first draft of the report has not been released by SCS.

East Fork of White-Patoka River (Ind.)

Between Department and Congress. Exact status unknown.

East Willow Creek (Minn.)

Undergoing Forest Service review.

Honey Creek (Iowa)

Report is being prepared by SCS.

Kentucky River (Ky.)

Report is being reviewed by Forest Service.

Licking River (Ky.)

First draft of the report is prepared and is undergoing Forest Service review.

Lost Creek (Mo.)

Forest Service review is completed and our comments have been sent to SCS.

Money Creek (Ill.)

Forest Service review comments have been sent to SCS.

Nishnabotna (Iowa., Mo., Neb.)

Field work commenced in April, is about 80 percent done. This watershed, included in the "373" report (Agricultural Comprehensive Program for the Missouri Basin), is scheduled for completion in mid F.Y. 1953.

Old Tom Creek (Ill.)

Forest Service review comments have been sent to SCS.

Red River of the North (Minn., N. Dak., S. Dak.)

Becker and Morey made a reconnaissance of this watershed in April. Evidence of wind blown sediment in drainage ditches brings up the question of the value of shelterbelts in a flood control program in this watershed. Unfortunately, no data are available for determining the feasibility of using the shelterbelt measure.

Scioto River (Ohio)

Report has been submitted to Congress.

Sny River (Ill.)

The report has been printed as House Document No. 398 of the 82nd Congress, 2nd Session.

South Fork of the Crow River (Minn.)

Becker and Morey completed the field work in this watershed during flood time in April. This watershed lies in the prairie--lake region of western Minnesota, where the marshes, ponds and lakes spill water over the roads, fields, and other property when their storage capacities are filled. As present land management methods are poor, it appears that proper land management might well serve to reduce flood runoff here. Sheet erosion is considerable on the over-corned rolling land; frequently the A₂ horizon is gone. The farm forests, principally comprised burr oak, are grazed heavily. Drainage is being advocated as a relief measure, but this would only make matters worse downstream--the water has to go somewhere. It is our opinion that part

of the answer lies in increased water storage in the soil mantle.

Switzler Creek (Kans.)

Status unknown.

Upper Blackwater River (Mo.)

This "373" report has not been released by SCS.

FOREST INFLUENCES ACTIVITY

Buckeye Research Center

General

A tract of land, to be known as the Vinton Furnace Experimental Forest, has been leased. The tract is located in Vinton County, Ohio and will be available for research in forest management and influences. A hardwood forest covers its 1,200 acres. Generally the stands are even-aged. Stand ages vary from 30 to over 80 years. Oaks and hickories are very abundant; some shortleaf pine and yellow poplar are to be found. Forest conditions are similar to those prevailing over large areas in southeastern Ohio.

Muskingum loam and silt loam are the dominant soil types on the experimental forest as elsewhere in the region. The Wellston, Zaleski, and other series are also found but their combined areas are small.

Soil Moisture Study

The soil moisture study started in April 1951 was concluded in April 1952. Publication in S.S.S.A. Proceedings is anticipated. Results obtained are summarized.

a. Moisture constants

Moisture equivalent and permanent-wilting percentages (direct determination) agree very closely with sustained maximum and minimum field moisture levels (gravimetric determinations). These constants are useful in the estimation of the range of readily available water.

Soil texture, bulk density, and organic matter content are the principal determinants of the limits over which water is readily available. The availability of water in soils of the Muskingum-Wellston-Zanesville is given in the tabulation which follows (based upon 341 horizons):

<u>Texture</u>	<u>Horizon</u>	<u>Inches of readily available water per foot of horizon</u>
Loamy sands	A ₂	1.0
Sandy loams	A ₁	1.5
" "	A ₂	1.5
" "	B	1.7
Loam	A ₁	2.0
"	A ₂	2.0
"	B	2.1
Silt loam	A ₁	2.4
" "	A ₂	2.5
" "	B	2.6
Silt	A ₂	2.5
Sandy clay loam	B	1.8
Clay loam	A ₂	2.7
" "	B	2.3
Silty clay loam	A ₁	2.3
" " "	A ₂	2.3
" " "	B	2.3
Silty clay	B	2.2
Clay	A ₂	1.9
"	B	2.2

A one percent increase in the silt-plus-clay fraction of A₁ and A₂ horizons is accompanied by a 0.16 percent increase in readily available water. A one percent increase in the incorporated organic matter content of A₁ horizons is accompanied by a one percent increase in the readily available water. The relation of readily available water to the texture of subsoil horizons is non-linear; maximum values obtain at a silt-plus-clay content of 80 percent. Inasmuch as the bulk density of A₁ horizons is much lower than A₂ horizons, the transformation of part of an A₂ horizons to an A₁ (say, under the influence of forest) does not result in an important gain in the capacity to hold readily available water.

b. Field Moisture

The soil profiles examined reached their field capacities about January first and remained in that condition until the appearance of foliage. By the twelfth week of the growing season, all horizons

simultaneously approached the permanent-wilting percentage. The pattern of wetting of plastic subsoils appears to be one of expanding pockets rather than blanket wetting from above such as that obtaining in the more permeable soils.

Yearlong trend lines for readily available water (in inches) in the first three feet of the soil profile are given by the following equations (See Fisher and Yates "Statistical Tables" for orthogonal functions when $n = 52$) :

Wellston silt loam

$$Y = 4.57 + 0.024 \xi_1' + 0.011 \xi_2' - 0.00064 \xi_3' - 0.00039 \xi_4' + 0.000021 \xi_5'$$

Muskingum loam

$$Y = 5.19 + 0.033 \xi_1' + 0.0097 \xi_2' - 0.00068 \xi_3' - 0.00036 \xi_4' + 0.000031 \xi_5'$$

Zaleski loam

$$Y = 4.99 + 0.035 \xi_1' + 0.0081 \xi_2' - 0.00064 \xi_3' - 0.00041 \xi_4' + 0.000029 \xi_5'$$

The cumulative loss of moisture from the entire zone of soil containing roots during the growing season amounted to 13 inches from the Wellston soil, 12 inches from the Muskingum soil, and 23 inches from the Zaleski.

If it is assumed that all readily available water is extracted during the growing season, that there is no runoff from forest soils during that period then, evaporation and transpiration during the growing season account for all but 15 inches of the mean annual precipitation of 40 inches.

c. Remarks

Other studies of this nature are being planned. Henceforth greater emphasis will be placed upon obtaining data on the climate near the ground.

QUARTERLY REPORT OF THE FLOOD CONTROL SURVEYS DIVISION
Northern Rocky Mountain Forest and Range Experiment Station
April - June, 1952

For this period, emphasis of the Division of Flood Control Surveys was directed toward compiling the necessary basic data and establishing procedure for program and hydrologic evaluations.

Land Use

Efforts of the Land Use Section during the quarter were spent almost exclusively in compiling the necessary basic data for forest and range program evaluation within our area of responsibility. At present all basic data necessary for forest and range evaluations, except program measures, have been compiled. Methods and procedures for evaluations have been determined by the Land Use Subcommittee. Sample forest and range evaluations have been processed. Until final program data are available, however, completed evaluations cannot be made.

During the past month the Land Use Section has actively assisted NFA in apportioning the former Unit III total CBAP by states by agencies to the two supplemental report areas for which we are responsible. This apportioning job should be completed by early July, at which time final and complete program evaluations can be made.

As a fill-in job the Division has started "roughing out" the area characteristics section of the Clark Fork supplemental report area. All available time not necessary for the preparation of the general report will now be directed toward preparation of the Clark Fork supplemental report.

Hydrology

Determination of the number and total capacity of multi-purpose structures is moving ahead. The selection of these structures was correlated with Soil Conservation Service and Bureau of Reclamation personnel.

Some progress is being made in determining the effects of the program in reducing peak flows, hence, reduction in damages.

Economics and Damages

A correlated summary of estimated future flood damages without the CBAP has been completed. Data for agricultural lands were provided by the Soil Conservation Service and for non-agricultural lands by this Division. Flood frequency calculations for past floods in the Upper Columbia Area have been completed. These frequencies have been related to non-agricultural damages on the sample watersheds and damage-frequency curves constructed. Total damage-frequency curves will be prepared when needed data are received from the Soil Conservation Service.

Considerable time was devoted by this section to program evaluations.

Winter Field Operations

Priest River Experimental Forest

Snow measurements on all special snow courses have been completed for the season. A limited precipitation net at the Priest River Experimental Forest will be continued during the remainder of the water year.

Marias Pass

All meteorological measurements at the Marias Pass Snow Laboratory have been permanently discontinued. Property has been returned to the Army Corps of Engineers. The buildings at the site will be disposed of. Soil moisture measurements at the site will be continued for the summer to complete the "moisture year." Cover types on the snow courses will be classified in order to relate snow accumulation and melt to cover conditions.

Status of CBAP

The general CBAP report is slowly being molded into final form. Our contributions to the Area Characteristics and Problem sections are virtually complete. The total program for all agencies is approaching final form, although not yet completely apportioned to supplemental report areas. The separation of program measures into "flood control" and "other" is yet to be done and final evaluations made. Also, the hydrologic effect of program measures on peak flows and damage reductions must be determined.

Miscellaneous

Director George M. Jemison and H. W. Camp, Jr., Chief of this Division, attended the Montana Council of State and Federal Agencies at Hungry Horse on June 13, where Mr. Camp gave a talk on water management research as being carried on by the NRM Station in the Columbia Basin. Camp also attended the Montana Academy of Sciences Conference at Bozeman on April 11, 1952.

Friedrich attended an Economic Subcommittee meeting at Portland during mid-April. Procedures for economic evaluations were established at this meeting.

The Land Use Subcommittee meeting at Portland, beginning May 4, was attended by Camp and Weyermann. Evaluation procedures were determined.

Weyermann and Sutliff contacted Bureau of Land Management and Bureau of Indian Affairs officials at Billings during mid-April to review their final non-recurrent program, establish recurrent program costs, and collect evaluation information.

Austin Helmers will head up a new soil and soil moisture study which was recently started at the Priest River Experimental Forest in

cooperation with the Army Corps of Engineers. The study will be primarily concerned with soil characteristics and how moisture contents vary throughout the season. Studies will be made of infiltration and the rates of drying on both forest and non-forest areas.

Paul Ingebo conferred with Bureau of Reclamation officials at Spokane and Soil Conservation personnel at Pendleton late in May. He also contacted Montana State Engineer Buck during early June. Future storage and structure needs were determined and correlated.

QUARTERLY REPORT ON

FOREST INFLUENCES AND FLOOD CONTROL SURVEYS

July 1, 1952



FLOOD CONTROL SURVEYS

by Norman R. Tripp

STATUS OF FLOOD CONTROL SURVEY REPORTS

Connecticut River.--In Secretary's Office.

Merrimack River.--Step 2 draft completed in manuscript.

Salt River.--Step 8 draft in process.

Allegheny River.--First draft in process.

Upper Susquehanna and Monongahela Rivers.-- No further progress.

Potomac River (Review Report).--Planned field work completed--further work awaiting additional funds.

NE-NYIAC--Resources Survey.--Still plugging along. No change in target date of February 1953.

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Further Discussion -

We would like to begin by thanking Maeyers for his contribution to the discussion. Particularly so because he has expressed so succinctly the point of view of a considerable number of people in the Department--the very point of view which we believe is much too restrictive and with which we are taking issue.

This point of view says that those of us who are in opposition misunderstand the objective of flood control. The difference of opinion is not

in understanding of the objective--that, of course, is to reduce flood damage--but rather in definition of the word "flood." What is this flood we are trying to control? Does it occur only on permanent streams? According to Webster a flood is -

A great flow of water.
A body of moving water.
A deluge.

The American College Dictionary says a flood is -

A great flowing or overflowing of water,
especially over land not usually submerged.

There is nothing in any of these definitions which confines flooding to the proximity of rivers and streams.

The 1936 Flood Control Act, Section I (from which Maevers quotes) sets up Federal policy. Section II of the same Act which sets up procedure and delimits responsibilities says -

That hereafter Federal investigations and improvements of RIVERS and other waterways for flood control and allied purposes shall be under the jurisdiction of and shall be prosecuted by the War Department and Federal investigation of WATERSHEDS and measures for RUN-OFF AND WATERFLOW RETARDATION AND SOIL EROSION PREVENTION ON WATERSHEDS shall be under the jurisdiction of and shall be prosecuted by the Department of Agriculture.....

There is certainly nothing here that limits us to consideration only of flooding by high stream stages.

Recently we investigated a flash flood on a small stream in Vermont. We found that, after an unusually heavy rain, water seeping through the ground or running over the surface down a steep mountain side had been collected by an old wood-hauling road. After running down the wood road for half a mile the water had turned onto a main highway. The highway was gutted out for nearly a mile before the water turned off into a small stream channel which parallels the highway. Further down the water had jumped over into the highway and again washed out a considerable length before returning to its channel. By Maevers definition, only that portion of the damage caused by water from the stream would be classed as flood damage--the damage above is no concern of ours because the water had never run in a normal geologic watercourse. Suppose that if instead of entering the stream the water had turned off the highway in the other direction, carrying its load of water and debris onto some farmer's field and ended there--by definition no flood,

no flood damage--we wouldn't even attempt to devise a program.

To us this seems a ridiculously narrow point of view and one which we have apparently brought on ourselves since we can find no mandate for such limitation. The flood we would prefer to control is "any unusual or unnatural damaging flow of water wherever it may occur." Any damage resulting from such a flow we would consider "flood damage."

We in Agriculture are charged with the protection and management of the soil resource to the end that it may continue to yield products beneficial to mankind without itself being deteriorated. Water is both a beneficial product and a deteriorating agent. From the land manager's point of view the mandate from Congress which charges the Department with responsibility only for waterflow RETARDATION instead of for waterflow REGULATION is sufficiently unfortunate in its limitation. Carrying functionalization to the point where one group is charged with developing plans for retarding the flow of water, while another group plans for improving the flows in the same area is bad enough. Further specialization, which would charge Flood Control with responsibility for retarding only that part of the flow which will cause damage within the narrow limits of a stream channel, piles absurdity upon absurdity.

Why should we force ourselves into specialization? Why should we limit ourselves to designing programs to deal only with the thousands of dollars in damages along our rivers when damage from runaway water over the land runs into the millions?

If our attitude is a hang-over from the traditional flood control programs as carried out by the Corps of Engineers, it is time we took a fresh look at our own responsibilities.

If this attitude comes as a reflection of present thinking in the Congress it is high time the true facts are presented to them in proper perspective.

Our job is to conserve the land and water resource. If we can pick up some incidental benefits along the rivers, all the better, but let's don't get the cart before the horse.

FOREST INFLUENCES
DELAWARE BASIN RESEARCH CENTER

by Irvin C. Reigner

General

The highest annual rainfall since the beginning of measurements at the Dilldown Watershed, a record of 60 inches set last hydrologic year, probably will be broken this current year. By the end of May, over 50 inches of precipitation had fallen over the watershed, as compared with less than 44 inches during the same period in the record year of 1950-51.

With four more months in this hydrologic year still to be accounted for, total rainfall should easily exceed 60 inches.

Even with this exceptionally high rainfall, over 10 inches in April and almost 7 inches in May, one of the worst spring fire seasons on record was experienced in the Dilldown area. This was due mainly to poor distribution of rainfall during the most critical period. No rain fell from April 24 to May 10, during which period temperatures were high, humidities low, and the vegetation not yet in leaf.

Fortunately, the watershed escaped burning, although it took fast, efficient control by Gene McNamara and his associates on May 8 and 9 to put out two incendiaries in the adjacent drainage.

Soil Moisture Studies

Charley Carlson of the Southern Station, now on detail to the Vicksburg Infiltration Project, visited the Research Center in May to review our soil moisture studies. From previous contacts between the Center and the Vicksburg Infiltration Project, the latter found a need for the Delaware Basin soil moisture measurements, tabulations, and calculations to date. As these calculations were not complete throughout the periods designated by the Vicksburg Infiltration Project, and as the desired form of the tabulations was somewhat different from our form, considerable clerical work was necessitated to complete and transcribe the data.

Ultrawet and Kriliun Tests

Bethlahmy and Reigner assisted Dr. W. E. McQuilkin of the Anthracite Research Center in the establishment of plots testing these two soil conditioners. The plots are located on strip mine spoil banks in the vicinity of Wilkes-Barre.

The ultrawet study, which was established about the beginning of May, tests the effect of the chemical on the direct seeding of red pine. These

plots are on generally level ground and additional plots were established on steep slopes which were treated with the chemical and then seeded with a grass mixture.

Krilium, which was not delivered until June, was used to treat seedlings planted earlier this season. The trees were treated individually and at random, causing plots to vary considerably in size. The effect of krilium on survival and growth will be noted during the next two years.

As in the ultrawet study, krilium was applied to plots on steep slopes to determine any effect on decreasing erosion on loose, unconsolidated material at these steep slopes.

Ned Bethlahmy will later test the effect of both soil conditioners on increasing infiltration. However, the difficulty in measuring infiltration on slopes of 45 degrees or more appears to be considerable.

Scrub Oak Conversion

Continuing the search for the best adapted species to be planted on scrub oak lands and the most efficient techniques to establish them, several small interrelated studies were begun this spring. Two hardwood species not previously tested, tulip poplar and black cherry, were planted. High quality red oak acorns were seeded by two methods, directly into the native soil and in cardboard cartridges containing a more fertile soil.

In conjunction with the new species tests, openings were prepared in the brush by poisoning in which the young plants might grow without competition. The most promising of the coniferous species were planted in these poisoned spots in addition to the above species. Similar plantings were made in adjacent untreated plots to serve as a control on the site treatment. The new species were also planted under the various methods of mechanical site preparation tried previously.

Another related study was begun to test more fully the effect of various herbicides and different concentrations of each on scrub oak brush. Plots were established on the fire lines surrounding the experimental forest to study these variables and larger stretches of fire line were treated with a high concentrate poison to determine costs of controlling brush on fire breaks.

All studies were undertaken jointly by the Northeastern Station and the Pennsylvania Department of Forests and Waters.

Interception

All previous installations at Dilldown and at the Pocono Experimental Forest measuring thrufall and stemflow were reactivated this spring. One new stemflow installation--on rhododendron within the high forest stemflow area at

Dilldown and beneath the overstory--is in the process of establishment. Certain improvements in the old installations have been made including the replacement of some of the stemflow collector cans with much larger containers. A fifty-five gallon oil drum has been installed at each of two nine-inch beeches, while two eight-inch red maples and a six-inch ash each required twenty-five gallon collectors. These capacities are necessary to collect the stemflow from a two-inch rainfall and we hope to avoid overflows this season.

Advisory Council Meeting

Split Rock Lodge in the Poconos was the locale of the annual meeting of the Northeastern Forest Research Advisory Council. Held Friday and Saturday, June 13 and 14, the meeting was well attended by members and guests from industries, state forestry services, schools, and the Federal Service.

Following opening remarks by Chairman Paul Koenig, members of the Station Staff discussed present research activities in the Northeast and special problems of the Experiment Station program. Regional Forester Swingler spoke on the Timber Resource Review and Fred Simmons discussed findings of the Equipment Manpower Survey. Dr. E. C. Crafts, Assistant Chief from the Washington Office, brought the group up to date on the latest Forest and Range Legislation before Congress.

Marinus Westveld spoke on evaluating forest site quality by the use of plant indicators and soil survey data. Dr. Bill Bramble discussed plans for research in oak wilt in Pennsylvania.

A movie prepared by the Interstate Commission on the Delaware concerning its program to utilize the water resources of the Delaware Basin was shown Friday evening. A highlight of the meeting was the flash announcement by Dr. Crafts of Mr. Swingler's promotion to Assistant Chief of the Forest Service.

Saturday morning, the group journeyed to the Delaware-Lehigh Experimental Forest. Storey and Reigner explained the major phases of the Dilldown Watershed project as the various points of interest were visited, while Dr. McQuilkin told the group about the scrub oak conversion program.

Personnel

Ned Bethlahmy has been on leave most of June increasing his considerable knowledge on forest soils. Ned is attending a forest soils seminar being given by Dr. Coile at Duke University.

Harry Price, our versatile clerk, accepted a transfer to the Southern Station during the quarter. He is now located at the Gulfcoast Research Center, Gulfport, Mississippi. We were not happy about Harry's departure, as he had been with us since the establishment of this Center and was very capable. However, he has been ably replaced by Miss Ann Coachys of Bethlehem. Besides having the ability to learn our varied and sometimes complicated routine in

short order, Ann helps considerably to brighten an otherwise drab office.

Ed Read and Ernest Kurmes, students at Lehigh University, have been hired to help with the soil moisture tabulations. Following the completion of this work, Ed will be our summer field assistant.

Visitors

Dr. Marquis spent two days with us in May going over the influences work at Dilldown and at the Pocono Experimental Forest. This Center has the distinction of being the first to get our Director stuck in the mud, then adding insult to injury by splattering him with mud from head to toe.

Dick Trimble of the Mountain State Research Center spent most of one week here observing our soil moisture procedures in detail.

Spence Potter, who is now engaged in analyzing frost data in Upper Darby, was given a look at the field installation in the vicinity of the Pocono Experimental Forest by Ned Bethlahmy.

Hal Wilm and Walt Zillgitt of the Washington Office paid a brief visit to the Delaware-Lehigh Forest during their inspection of the Station. While at the fire tower we gave them a taste of thunder, lightning, cloudburst and heavy wind.

MOUNTAIN STATE RESEARCH CENTER

by the Mountain State Staff

Rain Gage Pattern

We began our watershed study on May 1, 1951, using 15 standard rain gages on the five watersheds--approximately 26 acres per gage. At the end of one year of operation we have reduced the number to 10. Working with alternate Horton-Thiessen areas we found that the differences in watershed precipitation using measurements from 10 gages as compared to 15 were negligible. The comparisons were made both on a basis of monthly precipitation and on a basis of storms over .5" of rain.

Runoff as a Percent of Rainfall

The following table shows by months what percent of the precipitation ran off our watersheds during the growing season of 1951.

Month	Watersheds				
	#1	#2	#3	#4	#5
May	46.90	59.55	57.46	51.31	No record
June	34.63	41.07	39.38	40.26	No record
July	17.43	22.36	28.43	25.89	24.81
August	1.00	3.00	3.11	1.54	3.26
September	.32	.98	1.57	.65	2.34
October	.49	1.40	1.41	.05	1.48

Canopy Effects on Precipitation

During the dormant season of 1951 and 1952 we studied the effect of a fully-stocked hardwood canopy (without leaves) in reducing the amount and intensity of ground rainfall.

Five recording rain.gages were placed at random in an area of 50-year old hardwoods. Elevation, aspect, and slope position were similar for all gages. The control consisted of a recording gage in a 1/2 acre cleared plot within 100 yards of any canopy gage and similarly located with respect to elevation, aspect, and slope position.

Three comparisons were made between the measurements recorded at the open and canopy gages: (1) The amount of rainfall or throughfall, (2) maximum 5-minute intensities, (3) maximum 15-minute intensities.

Throughfall

The average difference, based on 33 storms, between ground rainfall in the open and under canopy was highly significant. $t = 8.1161$. The storms varied in amount of rainfall from .04" to approximately 1.50". The data plotted as a straight line, i.e. ground rainfall under canopy plotted over ground rainfall in the open. The following regression equation was determined to estimate ground rainfall under a canopy from that in the open:

$$Y = -0.00618 + 0.789x$$

Where Y = rainfall under canopy and x = rainfall in the open.

Using this equation the proportion of rainfall to reach the ground for several storms of different sizes is given below:

<u>Open Rainfall</u> (inches)	<u>Throughfall as a</u> <u>percent of rainfall</u> (percent)
.10	73
.50	78
1.00	78
2.00	79
4.00	79

The differences between catches in the several gages under canopy were relatively small. Standard deviations from the average throughfall for any one storm were generally less than five percent.

Intensities

The differences in intensities in the open and under canopy were highly significant for both 5-minute maximum and 15-minute maximum intensities. As would be expected, intensities under canopy were less than open rainfall intensities. Averaging all storm data, the effect of canopy is to reduce 5-minute maximum intensities by 19 percent and 15-minute maximum intensities by 15 percent.

As in the case of throughfall, standard deviations from the canopy average for any one storm were generally very small.

This study is being continued through the summer to test the effect of the same canopy when the leaves are out. We expect to have a full report ready in the fall of 1952.

THE HISTORY OF THE

The history of the world is a long and tedious story, but it is one that is full of interest and variety. It is a story of the human race, of its struggles, its triumphs, and its failures. It is a story of the great empires, the great wars, and the great discoveries. It is a story of the human mind, of its power, its limitations, and its potential. It is a story of the human heart, of its joys, its sorrows, and its hopes. It is a story of the human spirit, of its strength, its weakness, and its resilience. It is a story of the human race, of its past, its present, and its future. It is a story of the human condition, of its meaning, its purpose, and its value. It is a story of the human experience, of its richness, its complexity, and its beauty. It is a story of the human world, of its diversity, its unity, and its harmony. It is a story of the human race, of its history, its culture, and its destiny. It is a story of the human race, of its past, its present, and its future. It is a story of the human condition, of its meaning, its purpose, and its value. It is a story of the human experience, of its richness, its complexity, and its beauty. It is a story of the human world, of its diversity, its unity, and its harmony. It is a story of the human race, of its history, its culture, and its destiny.

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PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
Division of Flood Control Surveys

Quarterly Progress Report, April 1 - June 30, 1952

Columbia Basin Flood Control Survey and Agricultural Program

A follow-up of the Land Use Committee meeting reported on during the previous quarter was held here on May 3-7. This meeting was devoted largely to trying to straighten out the difficulties involved in evaluating the benefits of the program on both forest and range lands. Procedures for range land have been pretty well worked out and agreed upon, but the forest evaluation is still in somewhat of a state of flux. Detailed theoretical evaluations have been worked out on a trial basis, but we would like to come up with a more practical, short-cut method. The issue is complicated by several factors. One is the difference between regions in the kinds of data available from Forest Survey (one group has none). Another is the fact that benefits must be based on the differences between future conditions with the going programs and future conditions with the accelerated program. That makes it necessary to project into the future the status of forest lands under present levels of management. That means that in this region where there is still a considerable amount of old growth, we must predict how long it will be before the old, mature stands will be replaced by young stands which can be put under intensive management. In addition, our estimates of average annual growth in the future with the program should be somewhat in line with regional growth goals set-up by the Forest Service. To add further confusion, the coming Timber Resources Review may considerably alter estimates of this nature set forth in the Reappraisal.

Physical program measures for National Forest lands including unit and total installation costs for the going and total programs have been worked out for all sub-divisions of the basin. The program material for other federal and for state and private lands is now undergoing similar treatment. Twerdal has worked practically full time on this job for the last two months.

Bob Hobba, our hydrologist, returned from the statistical school to find the Welcome sign hung up with several requests for urgently needed information attached thereto. As a result, he took off shortly for Berkeley to confer with Anderson on problems of mutual interest to multiple-regressionists, with a stop-off at the Western Snow Conference meeting enroute. Later, he met with Rosa of the Intermountain station to discuss with him the hydrology procedures which we had used for the Oregon portion of the Lower Snake River sub-division, and to see how they would fit in with the hydrology which the Intermountain group is working up for the rest of the sub-division. While the methods used are completely different - Hobba's being multiple regression, and Rosa's being flood routing procedures - it was found that both employ essentially

the same variables for evaluating snow melt floods. Rosa's method is based on snow course measurements from which they found snow accumulation and rate of melt to be correlated with forest density. Hobba's regression equation found to best express peak flow used a combined meteorological variable plus an expression of the amount of poorly stocked and logged or burned forest land. The multiple correlation coefficient of this equation is .889, and all variables satisfied tests of significance. For evaluating summer storms, both will introduce expressions of range conditions.

The division has turned over to the Intermountain group all the completed program and damage data we had for the northeastern Oregon area. Part of this transfer was affected by Bullard and Fittinger who met with Adams at Baker during the latter part of May. Accompanied by Adams, they travelled over parts of the area and visited several supervisors' offices and district rangers' headquarters to get some on-the-ground opinions regarding some of the program material.

Sartz has been working with a representative from the SCS in preparing a set of instructions on format of the report and appendices. The instructions, which are aimed at getting uniformity of material submitted by different people, have to do with spacing, width of margins, indentation, proper use of under-lining, etc. Separate instructions will be prepared for text material, for tables, and for maps and figures. They should be forthcoming early next month.

To get rid of a backlog of charts, graphs, and maps which needed doing, Lee Still, a draftsman, was hired in May.

Advance Studies

Rocky Mountain trapezoidal flumes for stream gaging were installed on the three small tributaries to Lookout Creek which have been selected for influences study on the Blue River Experimental Forest. The installation job was done on contract, with Hale supervising. The contract, however, did not call for mounting the gage houses on the stilling well casings. The houses were constructed at the regional equipment shop in Portland and were hauled as close to the gage sites as the construction roads permitted. At one site, this happened to be about fifty feet vertically above the installation. Hale and Sartz, with the assistance of a local member of the Division of Forest Management, a winch-equipped truck, and various and sundry chains and blocks and tackles, managed to "high lead" them into place, but for inaccessible sites such as these, it isn't recommended. It would have been better to have them in sections which could be more easily handled.

Hale is currently engaged in constructing entry platforms and ladders for the gage houses and installing the instruments, so measurements should start within a few weeks.

We would like to pass on some of the lessons learned from this installation job:

1. If you use flume boxes which have slots for regulating the water level, estimate the lowest flows expected before designing the flumes. In none of our flumes are the slots low enough to let water into the flume boxes at present flows. We had to drill holes below the slots to let water into the boxes and wells.
2. Provide screw caps for all pipe threads to prevent damaging them during construction.
3. Provide a means of shutting off water flow into the stilling wells for cleaning purposes. Our shut-off valve will probably consist of a raw potato jammed into the diversion pipe.
4. Flume liner plates and boxes are not interchangeable. When having more than one set made at the same time, have them marked when they are fabricated.

Hobba, and Silen from Forest Management, made a short study comparing flows at three gaging stations on Blue River and its main tributary, Lookout Creek, to determine if any additional gages are needed. A simple regression showed daily flow at the two Blue River stations to be highly correlated. In addition, both of these flows were found to be equally well correlated with the flow of Lookout Creek.

Twierdal spent about two weeks early in the quarter putting contour lines on aerial photos of the experimental forest at the request of the division of forest management.

The stream sediment sampling program carried on during the winter season has been discontinued except for two tributaries of the Wallowa River which will be sampled all summer. One of these flows from an unlogged mountain watershed, the other through irrigated agricultural land.

The division recently acquired a soil moisture probe, which is an instrument that looks like a soil auger, without the auger. Instead of an auger bit, it has a small brass point separated from the metal shaft by a plastic spacer. Two wires, one connected to the brass point, and the other grounded to the shaft extend to a box, mounted on the handle, in which an ohmmeter is seated. When the probe is pushed into soil, the resistance is indicated on the instrument at the push of a button. The meter readings, of course, will have to be correlated with standard expressions of soil moisture. This instrument seems to offer the best idea yet for quick and easy soil moisture determinations. However, preliminary trials indicated that the model we have is not sensitive enough to be of much value in research work.

Cooperation

Bullard continued his activity with the Forest Soils Committee. One of the projects currently being undertaken by the members is a compilation of forest soils problems gathered from various organizations to be

submitted to the forestry schools as suggestions for students' theses. The manual of procedures for soils sampling and analysis is about ready for publication.

The regional engineering office recently hired a soil scientist, John Arnold, to continue work on the road drainage and soil stabilization study started last summer. He will be working under our general supervision and guidance. This is now a full time job, and probably will be continued for three or four years.

In mid-May, Bullard attended the CBIAC Water Pollution subcommittee meeting, and gave a progress report on the watershed protection study assigned to his work group. This study involves collection of data on water quality as related to watershed use, problems arising from watershed use, state and other regulations affecting this use, and research needs.

Late in April, Bullard and Fittinger made an inspection of the mustard seeding done last fall by the Bureau of Land Management on a 1951 burn in southwest Oregon. The catch was excellent, and coverage fair to good. We helped the Bureau of Land Management design a study to determine the persistence of the mustard, the effects on Douglas-fir regeneration, and the protection afforded against erosion; and expect to follow up with inspections again this fall and next spring.

Talks

Baudendistel gave a talk to the Agricultural Committee at the Wenatchee Chamber of Commerce on "Soil and Water Problems and Research Needs of the West - a Resume of Senate Document No. 98". Afterwards a short recording was made for later broadcast. As part of the address, he also outlined the plans we have made for influences research in the Entiat watershed.

On June 26, Baudendistel presented a paper at the Institute of Northwest Resources meeting in Corvallis on "Watershed Management Potentialities".

Bullard addressed the Northwest Industrial Waste Conference at Washington State College in March. His talk was, "Effects of Logging on Watershed Values". On April 25 he took part in a panel discussion on logging of watersheds at the Pacific Northwest Section meeting of the American Water Works Association. His assigned topic was "Effects of Logging on Water Quality".

Beeson, of the California flood surveys group, attended a meeting of the Oregon State Committee on Natural Resources held May 23 at Blue River. He presented a talk entitled "Progress Report on the Willamette River Watershed Survey" in connection with a hearing on the McKenzie River Basin.

People

Latest word from Bill Nelson tells of his move to Paris, which he says, he likes much better than London.

July 1, 1952

QUARTERLY REPORT
April 1 to June 30, 1952

Forest Influences Division
Rocky Mountain Forest and Range Experiment Station
Fort Collins, Colorado
- - - - -

Manitou Experimental Forest -- Front Range

Routine stream-flow records began during the latter part of March. Plans were completed for the third infiltration study of the six large native pastures. These studies are designed to determine the effect of grazing intensity on water-absorption rates.

The ponderosa pine 100-acre runoff-and-erosion plots were treated during the period. The treatment was applied to one battery of three plots and consisted of the complete removal of all trees and litter. This treatment simulated the treatment given to the 1-acre watersheds 2 years ago.

During the latter part of June the infiltrometers were calibrated for use on the experimental pastures.

Fraser Experimental Forest -- Continental Divide

The Fraser Experimental Forest was opened on April 1. Routine measurements of snow accumulations and melt were made during the period.

The flow from the Fool Creek watershed was the highest of record. The following tabulation summarizes the peak discharges which have occurred from the watershed.

TABLE 1

Peak Discharges

<u>Fool Creek</u>		<u>East St. Louis Creek</u>	
<u>Date</u>	<u>c.f.s.</u>	<u>Date</u>	<u>c.f.s.</u>
June 11, 1942	14.82	--	--
June 20, 1943	11.45	June 22, 1943	31.45
June 15, 1944	9.47	June 19, 1944	30.27
June 24, 1945	8.90	June 24, 1945	39.36
June 10, 1946	12.64	June 7, 1946	28.17
June 8, 1947	10.58	June 8, 1947	32.80
June 3, 1948	13.06	June 3, 1948	39.48
June 17, 1949	14.02	June 17, 1949	63.88
June 16, 1950	16.80	June 16, 1950	65.13
June 21, 1951	19.42	June 21, 1951	64.92
June 10, 1952	24.0 *	June 10, 1952	70.0 *

*Preliminary calculation.

The first part of the paper discusses the importance of maintaining accurate records of all transactions. It is essential for the company to have a clear and concise system in place to ensure that all data is properly recorded and stored. This will allow for easy access and retrieval of information when needed.

The second part of the paper focuses on the importance of regular communication and collaboration between all team members. It is crucial for everyone to stay informed about the company's goals and objectives, as well as the progress of various projects. Regular meetings and updates will help to ensure that everyone is working towards the same goals and that any issues are identified and resolved quickly.

The third part of the paper discusses the importance of maintaining a high level of security for all company data. It is essential to implement strong security measures to protect sensitive information from unauthorized access or theft. This includes using secure communication channels, implementing strong passwords, and regularly updating software and systems.

The fourth part of the paper focuses on the importance of maintaining a high level of customer satisfaction. It is essential to provide excellent customer service and to respond quickly to any inquiries or complaints. This will help to build a strong reputation for the company and ensure that customers are loyal and satisfied with their experience.

The fifth part of the paper discusses the importance of maintaining a high level of financial stability. It is essential to carefully manage the company's finances and to ensure that all expenses are properly recorded and paid. This will help to ensure that the company is able to meet its financial obligations and maintain a strong financial position.

Financial Summary		Operational Data	
Item	Value	Item	Value
Revenue	1000000	Production	500000
Expenses	750000	Inventory	250000
Profit	250000	Shipping	100000
Assets	1500000	Marketing	50000
Liabilities	1000000	R&D	75000
Equity	500000	Other	25000

During the forepart of June the weather was very warm and as a consequence, the rate of snow-melt very high. Observations of the snow-melt and stream flow from Fool Creek indicate that the construction of roads on the watersheds has resulted in considerable erosion. The water flowing through the Fool Creek flume during the period of peak discharges was muddy and carried much bedload. This was not true of the companion watershed, East St. Louis Creek.

Western Slope Research Center -- Delta, Colorado

A preliminary snow-melt study was carried out on Black Mesa Allotment at about 9,000 feet elevation. The results of the study are tabulated below:

TABLE 2

<u>Black Mesa -- Snow-melt</u>						
<u>Location</u>	<u>Dates of Measurement</u>			<u>Rate per day</u>		
	<u>4/23</u>	<u>:</u>	<u>5/9</u>		<u>:</u>	<u>5/23</u>
	<u>Water content in inches</u>					
<u>Mesa Creek</u>						
Open Park	24.9		12.6		2.0	.76
Spruce	15.1		4.6		2.2	.43
<u>Corral Creek</u>						
Open Park	18.6		4.6		0	.87
Aspen	15.4		2.6		0	.80

The rates of snow-melt were surprisingly high, indicating that the conditions controlling snow-melt are somewhat different than those found at the Fraser Experimental Forest.

Big Horn Research Center -- Laramie, Wyoming

No influences work under way or planned.

Publications

"Watershed management aspects of thinned young lodgepole pine stands" by B. C. Goodell has been published in the May issue of the Journal of Forestry.

Plans for a joint Departmental publication on "Factors affecting snow-melt and stream flow--Fraser Experimental Forest, Colorado" with the Bureau of Reclamation have been completed. It is anticipated that the final report of this cooperative snow investigation will be in manuscript form by next July. Two progress reports have been released concerning this study.

Personnel

Harry E. Brown returned to the Station on June 16. He had spent some 15 months with the Marine Corps in California. For the present his assignment will be at the Manitou Experimental Forest.

DIVISION OF FOREST INFLUENCES
SOUTHEASTERN FOREST EXPERIMENT STATION

PROGRESS REPORT

January - June 1952

SUMMARY

Coweeta Hydrologic Laboratory

Need for Hydrologic Evaluation of Class VI and VII Land

Requests for how to manage slopes above 18 percent are increasing. Guides based on hydrologic principles are needed for land planners who decide what part of a farm unit or watershed should be in grass or trees. There is need for a training meeting to overcome differences of opinion and set up criteria regarding use of tree or grass cover on Class VI and VII Land.

Effect of Forest Cutting on Stream Temperature

Following cutting of laurel and rhododendron understory, maximum stream temperatures showed a significant rise. Data suggest possibly forest vegetation along tributary streams can be manipulated to create a greater period of optimum temperature necessary for development of trout, while still keeping temperatures within limits of tolerance.

Effect of Poor Logging and Uncontrolled Cutting Practices on Water

High stream turbidities still persist 4 years after logging stopped. Analysis this quarter indicated annual water yields have increased from 15 to 20 percent following cutting of green timber.

Effect of Cutting all Shrub and Tree Cover and Annual Cutting of Regrowth

After the first year increases in water yield declined. This is attributed to establishment of herbaceous and shrub cover between sprouting stems of the original vegetation which intercepts rain and transpires water.

Hydrologic Notes

A 6-month record is given for air temperature, evaporation, rainfall, ground water and stream flow.

Wind

Analysis this quarter indicated that surrounding vegetation can materially influence wind velocities. Changes in ratios between 2 and 10 feet above the ground are summarized.

Piedmont Research Center

Organic matter percentages reported for surface foot of soil under various Piedmont forest stands.

Available soil moisture reported for study plots during quarter.

First meeting of Advisory Committee.

COWEETA HYDROLOGIC LABORATORY

Jan.- June, 1952

Need for Hydrologic Evaluation of Class VI and VII Land

Ever since the Secretary's Memorandum 1278, issued February 15, 1951, we are noting with increasing frequency requests and discussions by visitors on managing steep lands. According to Memorandum 1278, the Soil Conservation Service is responsible for classifying land based on its eight land capability classes. Of direct interest to the Forest Service are Classes VI and VII because, for certain conditions in these two classes, trees are recognized as the cover necessary for maintaining soil stability and producing some economic returns. For the land planner these classes are defined as follows:

Class VI- Land not suited for cultivation; should make good pasture with careful management and improvement through reseeding and fertilizing. It is also suited for trees. It washes easily and has steep slopes that range from 18 to 26 percent.

Class VII- Land not suited for cultivation but suited for grass or trees with very careful management. It has shallow soils that wash easily, and steep slopes that range from 26 to 60 percent.

The above definitions are certainly adequate in removing these lands from cultivation. It appears from the above, however, that grass and tree cover are roughly equivalent in prevention of washing and in stabilization and preserving desirable hydrologic properties of the soil. This assumption may not be correct; certainly for Class VII on the basis of present data, trees would appear to be a more desirable cover where slopes run up to 60 percent on shallow soils. For one thing, it may be difficult to maintain a grass cover on such slopes over a long period of time. These two land classes are much too broad in scope and are not adequate guides

for the land planners who must decide on a farm unit or watershed basis what part should be in grass and what part in trees. Specifically, more information and data are needed on: probable income, treatment procedures and hydrologic properties of both a tree and grass cover in preserving soil and water values for slopes above 18 percent. Many of the present farm planners are not acquainted with farm forestry economics or substituting of tree crops for difficult-to-maintain pastures. There is need for a training meeting to overcome present differences of opinion and set up criteria regarding use of tree and grass cover on Class VI and Class VII land.

Effect of Forest Cuttings on Stream Temperatures

Dense understories of laurel and rhododendron in mountain hardwood stands are sometimes 10 to 20 feet tall with a diameter of 9 inches at breast height. It is believed that these plants transpire considerable quantities of water throughout all seasons of the year. In making orientation studies of the amount of water used by different types of vegetation, a watershed experiment was carried out in which a dense understory was completely cut to the ground over a 70-acre drainage area. As a side-light on this study, stream temperatures were measured on the cut area and an adjacent control watershed of 60 acres, in order to measure changes which might result from the treatment. At a fixed station in rapidly flowing water, weekly maximum and minimum temperatures were started in 1947 and have continued to date. Treatment was put into effect January to March 1949. Leaves on cut vegetation still persisted during the 1949 growing season and provided sufficient shading so that no changes were observed. After these leaves dropped the post treatment mean maximum temperatures show a significant rise, table 1. The monthly mean minimum temperatures do not show any definite trend.

A slight rise in temperature along forested streams is not always bad for trout. Through removal of the understory and raising water temperatures during the dormant season there would be created a greater period of optimum temperatures necessary for growth and development of trout and aquatic organisms upon which they feed. Possibly forest vegetation along tributary streams can be manipulated to accomplish this result, while still keeping water temperatures within limits of tolerance.

Table 1.--Comparison of average monthly stream temperatures for undisturbed control and watershed with laurel and rhododendron understory cut. By before and after treatment periods.

Maximum stream temperature expressed in degrees F.									
Month	1947			1950			1951		
	Before			After			2nd year after leaves		
	dropped from cut vege-			dropped from cut vege-			dropped from cut vege-		
	tation			tation			tation		
	Control	Treated	Diff.	Control	Treated	Diff.	Control	Treated	Diff.
Jan.	48.5	48.5	0	52.0	54.6	+2.6	42.6	44.8	+2.2
Feb.	41.2	42.2	+1.0	51.2	51.8	+0.6	43.5	46.6	+3.1
Mar.	43.2	43.8	+0.6	48.8	49.8	+1.0	48.0	49.9	+1.9
Apr.	51.8	52.8	+1.0	54.2	55.0	+0.8	49.9	52.0	+2.1
May	56.0	57.0	+1.0	57.4	59.4	+2.0	56.2	58.1	+1.9
June	60.0	61.2	+1.2	60.5	62.9	+2.4	59.8	61.5	+1.7
July	61.0	62.0	+1.0	63.2	64.0	+0.8	63.4	64.6	+1.2
Aug.	63.0	64.2	+1.2	61.9	64.1	+2.2	64.5	65.2	+0.7
Sept.	63.2	64.5	+1.3	61.0	61.9	+0.9	63.2	63.8	+0.6
Oct.	57.8	58.2	+0.4	56.8	58.0	+1.2	60.4	60.2	-0.2
Nov.	50.8	50.2	-0.6	51.0	52.2	+1.2	51.5	51.5	0
Dec.	45.5	45.5	0	42.7	43.9	+1.2	48.5	49.0	+0.5
Total	642.0	650.1	8.1	660.7	677.6	+16.9	651.5	667.2	+15.7
Average	53.5	54.2	+0.7	55.1	56.5	+1.4*	54.3	55.6	+1.3

*Significant at 5 percent level; F_{test} 7.08; $F_{.05}$ equals 4.32 for land 21 D.F.

Effects of Steep Land Agriculture

The Station has received a copy of Robert E. Dils' completed thesis for the degree of Doctor of Philosophy. Dils, who is at present Asst. Prof. of Forestry at Michigan State College, was awarded his Doctorate in June. The thesis "Changes in Some Vegetation, Surface Soil and Surface Runoff Characteristics of a Watershed Brought About by Forest Cutting and Subsequent Mountain Farming" is a study on a Coweeta watershed converted to a mountain farm.

Hydrologists, engineers, conservationists, foresters and others will find the study extremely interesting and significant. More and more attention is being focused on hydrology of small headwater watersheds. Recurring floods in such areas generally do not come to the attention of the public in the same way that major floods become a natural catastrophe. Yet in total the flood damage in small watersheds on an annual basis probably exceeds the former. In this study the reader will see for himself how one type of land use rapidly causes a "deleterious effect on the water resource, soil-water relations, and on the quality and quantity of the vegetal cover."

A copy of the thesis is available to the Station for in-service use.

In the early morning hours of June 11 a local thunderstorm occurred in the area of watershed No. 3. It was a storm of very brief duration and fairly high intensity, although several storms in the past--as shown in the accompanying table--exhibited higher intensities. Of particular significance is the fact that peak flow for this storm, 402 c.s.m. is the second highest measured in the 17 years this area has been gaged. Peak flow in the storm of July 10, 1949, the highest on record, occurred after the stage had been set by previous rains which had saturated the soil. In addition, unusually large quantities of sediment moved into the streams. While comparable figures are not available for the other storms listed in the table, observations indicate that only the storm of July 10, 1949 and July 30, 1943 exceeded this one in movement of soil. Analysis of samples some 20 minutes after time of maximum flow yielded turbidities around 5,000 p.p.m. of material in suspension. Higher turbidities must have prevailed around the time of maximum flow, as evidenced by the considerable quantities of gravel and large stones up to 6" in diameter which were deposited in the ponding basin above the control section.

Table 2.--Steep land agriculture. Comparison of runoff
from summer storms. Post treatment period

Date of storm	Stream flow		Precipitation		
	: peak discharge	:	Max. Int. for		
			selected time		
			intervals		
			20 Min.	10 Min.	
	c.s.m. ^{1/}	In./hr.	In./hr.	In./hr.	
July 30, 1943	398	0.62	1.83	3.06	4.98
Aug. 25, 1947	113	0.18	2.33	4.50	5.10
Jul. 10, 1949	1849	2.87	2.88	4.11	4.44
Jul. 15, 1951	144	0.22	1.75	3.78	4.74
June 11, 1952	402	0.62	0.82	2.43	3.84

^{1/} c.s.m. equals cubic feet per second per square mile.

The above data coincide with observations and measurements of various kinds that the mountain farm is becoming more and more a flood hazard. It is a rather unique experience to eye-witness the progressive deterioration of the capacity of the watershed to control the movement of water under the impact of continued grazing. Observations during the storms and immediately following indicated (1) excessive channel bank cutting during the storm and (2) a well defined network of rills and gullies were established in the heavily trampled lower pasture, facilitating rapid movement of storm water and transportation of large quantities of soil.

Effects of Poor Logging and Uncontrolled Cutting Practices on Water

Four years after logging operations stopped, active soil displacement continues on the watershed. Material eroded from the road and skid trails continue to accumulate in the stream channels and is carried away as sediment during storms. The local thunderstorm of June 11, mentioned earlier, produced turbidities as high as 1400 parts per million.

Analysis this quarter indicated that water yields have increased following cutting of green timber on this poorly logged watershed. Before cutting, about 200,000 bd. ft. of merchantable green timber was estimated to be present on the 212-acre watershed. Eighty-six thousand bd. ft. of choice timber was cut and skidded off the area between May 1942 and the spring of 1943. A second green timber cut occurred during the period of April to October 1947 when 75,000 bd. ft. were cut from 25 acres in upper coves. Cutting continued in 1948 when 57,000 bd. ft. was cut between March through June and the balance of 37,000 bd. ft. cut in July and October. Although cutting recorded a total of around 1200 bd. ft. per acre in green timber, a large number of mature hickories and excessively deformed or decayed trees were left.

There was some increase in water yield following the "light selective cutting" in 1942-1943, table 3. After heavy cutting of green timber started in April 1947, noticeable streamflow increases were observed in October. These increases have persisted through 1951 and the trend appears they will continue but in decreasing amounts for another 3 to 6-year period.

Table 3.--Changes in water yield following unregulated cutting of merchantable green timber

<u>Year</u>	<u>Increase in annual water yield</u>	
	<u>Percent</u>	<u>Gallons</u>
1943	1.3	3,900,000
1944	7.5	17,500,000
1945	7.3	13,000,000
1946	6.2	17,800,000
1947	5.6	10,900,000
1948	9.8	23,300,000
1949	25.5	80,600,000
1950	17.2	46,100,000
1951	20.7	41,700,000

These data suggest there are opportunities in forest management practices for increasing flow from headwater areas supplying water for industries and hydroelectric power production. For areas where the commodity value of water far exceeds total value of harvested timbers and wood products, management objectives should be for sustained maximum flows of high quality water.

Effect of Cutting all Shrub and Tree Cover and Annual Cutting of Regrowth

Visitors at Coweeta while viewing the clear cut watershed often ask: "How does the present yield compare with the pronounced effect that occurred the first year after cutting?" After the first year, percentage increase declined (table 4). The reduction to low values during the 1943 to 1946 period is caused by annual regrowth which could not be cut during the war period. Decline to a 45-percent level for the 1947 to 1951 period is attributed to several factors. One is establishment over most of the area of complete herbaceous and shrub ground cover between the sprouting stems of the original vegetation, which intercepts rain and transpires water. For some portions another factor may be greater evaporation from exposed soil through decreased amounts of litter on the surface.

Table 4.--Changes in water yield for growing season following complete cutting of forest vegetation and annual cutting of natural regrowth.

<u>Year</u>	<u>Increase in May to October water yields</u>	
	(Percent)	(Inches)
1941	177 *	7.74
1942	73 *	7.18
1943	24 **	4.79
1944	15 **	1.18
1945	31 **	2.30
1946	34 <u>1/</u>	3.82
1947	52 *	3.96
1948	53 *	5.29
1949	25 *	5.58
1950	65 *	7.75
1951	36 *	3.39

* Years in which natural regrowth was cut.

** Years in which natural regrowth not cut.

1/ One-half of area cut during growing season.

Hydrologic Notes

Climate

The January to June period has been characterized by higher temperature than normal. This was especially evident during the last half of June when the daily maximum was recorded at 90° F. or above for seven straight days. An absolute maximum of 96° F. on June 27 was the highest temperature recorded at Coweeta, the previous high of 94.5° F. being recorded on July 1, 1940. The minimum temperature recorded during the period was 5° F. on January 30. In previous years, minimum temperatures as low as -15° have been experienced.

Table 5.--Climatic summary of air temperature and evaporation.

Month	Monthly mean air temperature						Monthly	
	Average		Maximum		Minimum		Evaporation	
	15-Yr.	1952	15-Yr.	1952	15-Yr.	1952	15-Yr.	1952
	°F.	°F.	°F.	°F.	°F.	°F.	In.	In.
Jan.	39.9	44.1	50.8	54.9	29.0	33.3	1.15	1.42
Feb.	40.8	43.0	52.8	55.1	28.7	30.9	1.68	1.72
Mar.	46.8	47.6	59.7	60.9	33.8	34.4	2.82	2.96
Apr.	54.6	56.0	68.2	68.5	41.0	43.5	3.76	3.72
May	61.5	62.8	75.9	77.7	47.1	47.8	4.10	3.87
June	68.7	73.2	82.0	87.5	55.4	58.9	4.03	4.29

Frost

The last frost of the winter season occurred May 12 at Weather Station No. 1, elevation 2250 feet, with a minimum of 31°F. This compares with an average date of May 2 and a late date of May 13. Colder temperatures were noted both at the medium and high elevations than on the valley floor. This is contrary to the typical, the late spring frosts usually being confined to the valley floor and/or the high country.

Snap beans were damaged from frost action, but other truck crops were not affected. Sassafras, ash, and oak leaves and terminal buds were nipped at medium and high elevations.

Wind

Wind measurements obtained during the last several quarters provide a noteworthy observation on the effect of surrounding vegetation on wind velocities.

Weather Station No. 1, the station at which these measurements were taken, was originally established in a 7-acre broom sedge field. Two acres of this field were utilized as an administrative site and remained in essentially the same vegetative condition with regards to wind movement as at the time of establishment. The weather station is located in one corner of this 2-acre triangular area.

The remaining portion of the broom sedge field gradually changed to brush and then to a forest stand 20 to 25 feet in height with a brush understory. An air pocket was thus established. This cover was removed in January, 1952, leaving the station essentially in its original condition.

Precipitation

Although precipitation has been above normal for the water year to date, it has been sporadic. March brought a marked excess of moisture but was followed by below normal rainfall during April, May, and June, the rainfall being approximately 20 percent below normal during the latter three months.

Table 6.--Precipitation summary, Coweeta Hydrologic Laboratory.

Month	15-Yr. average	1952	Deviation from average	No. of storms	
				15-yr. average	1952
Jan.	7.45	7.51	+ 0.06	12	10
Feb.	7.05	5.26	- 1.79	6	9
Mar.	7.58	16.03	+ 8.45	9	8
April	5.92	4.49	- 1.43	9	7
May	4.41	3.48	- 0.93	12	11
June	4.61	3.86	- 0.75	14	11
Water year to June 30	48.89	58.35	+ 9.46	62	56
Calendar year to June 30	37.02	40.63	+ 3.61		

Several high intensity storms with an areal distribution less than 15 sq. miles occurred during the period both around Coweeta and in neighboring communities. A severe storm occurred in Rabun Gap, Georgia, June 4. Approximately 4.18 inches of rainfall fell within an hour's time. Preliminary reports from TVA indicated that the estimated peak discharge of the principal branch of the storm area was from 3000 to 3250 c.s.m. This storm peak takes on particular significance in view of the fact that 90 percent of the drainage area is considered to be "improved pasture" and 10 percent grazed woodlands. The peak discharge is of the order of magnitude that has been recorded on Coweeta and Bent Creek from heavily trampled pastures.

A storm on March 10th and 11th produced the second highest storm peaks in Coweeta's history. The storm had unusual characteristics in that rainfall fell at a uniform rate for 14 hours with a recorded amount of 7.20 inches. Flood spillway sections on the multiple watershed weirs operated for the second time since their construction. Damage, particularly in older weirs, will cost several thousand dollars to repair. In addition, our road system suffered considerable loss due to inadequate culvert capacities.

However, excellent records were obtained during the actual storm and during the recession period. Since rainfall was uniform and stopped before the peak, preliminary examination suggests that for storm hydrograph analysis, this is one of the most valuable storms recorded to date.

Ground Water and Stream Flow

The moisture detention capacity of deep forest soils was well illustrated during and following the storm of March 10. Recession of sub-surface storm flows after the abnormally heavy rainfall continued over a three to four day period as shown in figure 1. Rapid rises of over 4 feet in the ground water table also attest to the rapidity of percolation in forest soils.

Following the last major storm in April, ground water depletion has been rapid until several ground wells were near a dry state on June 30. In general, the ground water level at this time was lower than during any year except 1941.

Stream levels also were correlated with the low rainfall during April, May, and June. High elevation watersheds with a shallow soil mantle showed the reduction in flow much more markedly than the low elevation watersheds characterized by a deep soil mantle. For example, Watershed #27, a high elevation watershed, had a low flow of .73 c.s.m. on June 30 as compared with 1.32 c.s.m. on Watershed #2, a low elevation watershed. In general, the same inverse relationship of flow to elevation held true throughout the area.

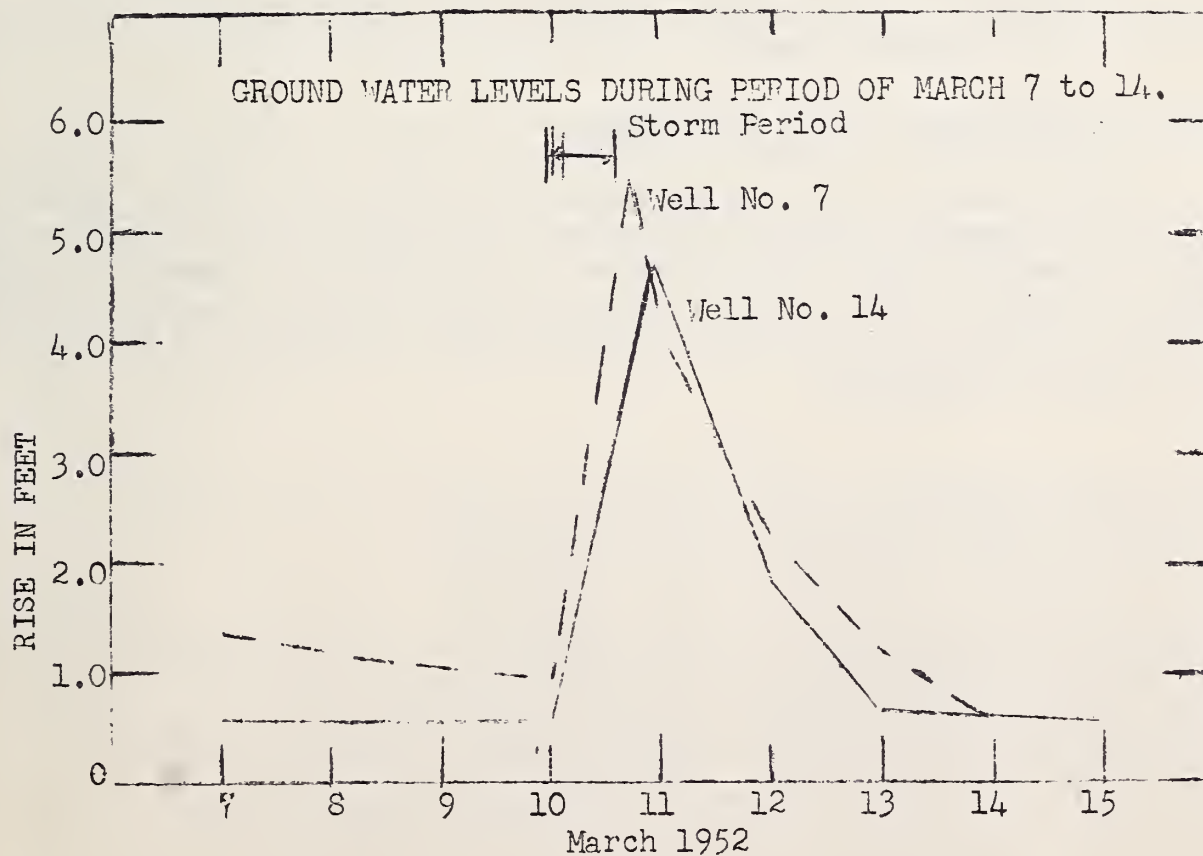


Fig 1

Miscellaneous

Thomas C. Nelson transferred from the Hitchiti Experimental Forest near Macon, Georgia, to the Division of Forest Influences and reported June 1. Nelson's assignment will be in a new phase of research at Coweeta, integrating the silvicultural aspects of forest management and water resource management.

Glenn Smalley, Michigan State College, reported June 23 to work on data towards his Master Thesis. Smalley has selected as his thesis, "Some Criteria for Determining Unit Control Areas for Watershed Management on Municipal and Industrial Watersheds in the Southern Appalachian Mountains."

Dorothy Crandall, Professor of Botany, Randolph-Macon University, Lynchburg, Virginia, spent June 10 to 28 tallying vegetation in mil-acre plots on land use watersheds. Office and field discussions were held on possibilities of using Coweeta data as a thesis for the degree of Doctor of Philosophy.

Leroy Jones, School of Forestry, University of Georgia, and W. Curtis, co-op forestry student, University of North Carolina, are here for the summer.

Cooperation with Georgia Agriculture Mobilization Committee

A coordinated water use and conservation plan for the State of Georgia was completed this quarter. Johnson spent considerable time during May drafting this 16-page report.

Cooperation with Federal Power Commission

E. R. Griffith, Regional Engineer with the Federal Power Commission, spent June 30 at Coweeta. This Commission is very interested in water used by forest vegetation and how water yields may be influenced through manipulating forest stands. Data from 5 watersheds where varying amounts of the forest stand have been treated were discussed and furnished for in-service use by the Power Commission.

Meetings and Training Sessions

Johnson participated in the Southeastern Station Work Center Leaders Conference, February 13-14.

Johnson attended the Seventh Midwestern States Flood Control Conference at Kentucky State Park, Hardin, Ky., May 28-29. At this meeting he presented a 30-minute slide lecture on "Watershed Management Research by the Forest Service at the Coweeta Hydrologic Laboratory."

The American Forestry Association will hold its annual meeting in Asheville, N. C., October 12-15. The theme of this meeting will be the relation of forests and water. One of the four scheduled field trips will be to Coweeta, October 14. Tentative estimates are that 200-300 people will take this trip. Several planning meetings have been held and arrangements are underway to develop a brochure for the trip and Coweeta display panels and photographs constructing bus turnarounds, comfort stations, and supplying a luncheon to be served on the area.

Inspection

A functional inspection and research program review was carried out by Dr. H. G. Wilm, April 9-11. This was the first inspection at Coweeta by Wilm. Many helpful suggestions were received as well as guiding principles for future research projects.

Coweeta was inspected by Barrett and Brown, April 23 as part of the Station's GI inspection. Johnson spent April 24 and 25 in Asheville, where the program phases of the inspection continued.

R. Pidgcon inspected the Coweeta road system June 26. Because Coweeta's objectives require crystal clear water in the streams, it was found that maintenance costs on our steep roads were higher than on National Forest roads. An on-the-ground inspection quickly demonstrated this need, and efforts are now underway to obtain adequate surfacing and maintenance funds. Also, betterment funds are necessary to avoid excessive flood damages that occur during each major flood due to inadequate culvert and bridge capacities.

Publications

Johnson, E. A. Effect of Farm Woodland Grazing on Watershed Values in the Southern Appalachian Mountains. Journal of Forestry, 50(2). February 1952.

A rough draft for within-Division use of the Coweeta Progress Report was completed April 1. This was reviewed by Wilm and following his suggestions the Progress Report was rewritten. Six of the seven chapters in this technical report were completed by June 30. Plans are to have a completed report ready for the first in-Station review by late summer.

Visitors

W. W. Woodhouse, C. H. M. Van Bavel, Agronomy Dept., N. C. State;
J. A. Rigney, Statistical Institute, N. C. State, Raleigh, N. C.,
Jan. 10.

Banan Gholam-Ali, and Jazirey M. Hasssein, Forest Engineers, Iran
Forest Service, Teheran, Iran, Jan. 16.

Tod C. Maurer, Regional Agronomist, SCS, Spartanburg, S. C., Jan. 17.

Willis King, and W. T. Carbino, Fish and Wildlife Service, Washington;
Morle A. Gee, Forest Service, W.O.; Edward E. Hueshe and Ancil Halloway,
Fish and Wildlife Service, Atlanta, Ga.; Duane Rawso, N. C. Wildlife
Resource Commission, Raleigh, N. C.; Charles Coffin, Forest Service,
Asheville, February 12-13.

L. K. Mays, Assist. Regional Forester, R-6, Portland, Ore.; W. C.
Callender, Region 8; W. Nothstein, Nantahala N. F., Feb. 28.

Twelve members of University of Tennessee, Hydrology Class, Knoxville,
Tenn., March 2.

R. J. Costoly, Supervisor, Allegheny N. F., Warren, Pa., March 10.

Eric Winters, Paul Johnson, S. L. Tisdale, Agricultural Research, TVA;
W. H. Snyder, Hydraulic Data, TVA; and W. W. Woodhouse, N. C. State
Agronomy Dept., March 18.

R. W. Mosher, Bill Bergoffen, Division of I&E, W. O., March 20-22.

Twenty-five Haywood County farmers, State Extension forester John L.
Gray, F. C. Lovely, Southern Pulpwood Cons. Association, Concord, N. C.,
March 20.

M. A. Benson, U. S. Geological Survey, Washington, D. C.; A. B. Goodwin
and Ed Burko, USGS, Asheville, N. C., March 26.

Howard A. Miller and L. S. Givens, U. S. Fish and Wildlife Service,
Atlanta, Ga., April 2.

Roy Silen, Forester, Pacific Northwest Station, April 3.

Fred Hornaday, American Forestry Association, Washington, D. C.
April 8, 9.

Thirty-five students, Geography Class, Franklin High School, April 16.

Forty students, Biology Class, Franklin High School, April 21.

Forty students, Biology Class, Franklin High School, April 22.

L. I. Barrett, A. A. Brown, Washington Office; Carl Ostrom, Asheville, April 23.

W. E. Wright, E. L. Nichols, Smokey Mtn. Trailways Co., Asheville, Apr. 28.

C. Edward Bohre, Forest Service, George E Bradley, FMS, Edward L. Greenfield, BAE, C. P. Barnes, Agr. Res. Adm., Washington, D. C.; John W. Barnard, SCS, Ford S. Prince, Agr. Res. Adm.; N. R. Tripp, Forest Service, Upper Darby, Pa.; Joseph A. Horn, FMA, Boston, Mass., April 29-30.

L. L. Gross, Forest Service, W. O., and J. A. Streinz, Region 8, April 29.

Twenty-two students, Vocational Agriculture Class, Rabun Gap-Nachoochoo High School, May 7, A. M.

Forty students, General Science Class, Franklin High School, May 7, P.M.

W. M. White, and B. F. Spradlin, Geologists, USGS, Shelby, N. C., May 14.

B. E. Wholan, and J. H. Dawes, Hydrologists, Upper Darby, Pa., May 20-21.

Supervisor, Cumberland W. F. and his staff and District Rangers, 11 individuals, W. E. Hodges, Region 7, Philadelphia, Pa., May 26.

Seven Austrian Foresters, Seaborn Johnson, Pisgah National Forest, June 7.

Louis E. Quell, Soil Scientist, SCS, Shelby, N. C., June 10.

Walter W. Saur, Braz., Gov. Forester, Lavras, Minas, Brazil, June 13.

Dr. Richmond E. Myers, Geologist, Pa. Water and Power Company, Lancaster, Pa., June 18.

Panos Pathanassopoulos, Minister of Agriculture Greece, Dirk W. Stolp, Research Scientist Soil and Water Conservation, Wageningen, Buissteeg 4, The Netherlands. June 22.

F. H. Bowman, Dept. of Biology, Emory University, Atlanta, Ga., June 24.

Thirty-five Clay County Farmers, Haynesville, N. C., June 27.

Dr. Samuel Robinson and Dr. Charles Lindsley, Asheville, N. C., and Mr. Michael Robinson, Seattle, Washington, Wilderness Society, June 29.

E. R. Griffith, Engineer, Federal Power Commission, Atlanta, Ga., June 30.

SOUTHEASTERN FOREST EXPERIMENT STATION
PIEDMONT RESEARCH CENTER

QUARTERLY PROGRESS REPORT
April - June 1952

Soil Moisture

Results this spring confirm the heavy drain on soil moisture at forested sites reported before. The table below shows this rapid withdrawal of moisture:

Inches of Available Water and Rainfall - Calhoun Soil Moisture Plots

Available Water - Upper 6 Feet of Soil

<u>Date</u>	<u>Loblolly Pine</u> (11-yr. old)	<u>Pine Hardwood</u> (40-yr. old)	<u>Broom Sedge</u> (Field)	<u>Barren</u>	<u>Rainfall</u>
March 31	7.71	6.39	7.20	6.40	-
April 30	6.14	5.27	7.39	6.38	3.60
May 31	3.47	3.42	5.68	6.10	2.83
June 20	2.60	2.91	4.48	5.42	1.33
Total rainfall	-----				7.76

Low soil moisture is the probable explanation for the comparatively smaller water use at forested plots than at the other plots during June. Even during April, pine roots were taking considerable water from a depth of six feet.

A large part of the work on this project during the quarter was the determination of volume weights and wilting points and the compilation and assembling of data. This information will be included in the final report on this project which is to be completed in the next 6 months.

Organic Matter Content of Piedmont Forest Soils

Previous reports have presented information on nutrient content of litter and weight of litter fall. The following table gives the percent of organic matter for various soil depths to 12 inches for the same plots where litter fall was measured.

Organic Matter Distribution in the Surface Foot of Soil
in Some Piedmont Forest Soils
(expressed in percent of oven dry weight)

Depth in Inches	Pine Stands			Pine-Hardwood Stands			Hardwood Stands		
	1	2	3	4	5	6	7	8	9
0-1	1.71	1.36	1.03	3.19	5.23	8.10	7.38	10.24	4.77
1-2	1.25	0.94	0.83	2.52	3.00	3.32	5.36	5.85	2.00
2-4	1.03	1.02	0.73	1.92	1.79	2.49	4.18	3.59	1.03
4-6	0.98	0.90	0.66	1.17	1.11	1.92	3.44	2.21	0.70
6-8	0.94	0.72	0.62	0.83	0.80	1.58	3.10	1.52	0.54
8-10	0.89	0.64	0.54	0.50	0.50	1.36	3.18	1.25	0.51
10-12	0.76	0.55	0.47	0.50	0.52	1.06	3.20	0.91	0.45

Each tabular value is the arithmetic average of 12 soil samples.

All of the differences in the above table cannot be ascribed to the effect of the vegetation on the site as the results are confounded with other factors, primarily, texture of the soil at the surface and the age of the vegetation. For example, stand one consists of 30-year-old natural loblolly growing on clay, stand three is an eleven-year-old loblolly plantation growing on sandy loam, and stand eight is a hardwood stand 150 years old growing on sandy clay loam.

In spite of the numerous variables involved the results do show that the vegetation has a marked effect on the organic matter incorporation.

It will be noted that in general there is a continual decrease of organic matter with depth. This does not always hold for individual profiles due to old root and animal channels and buried organic matter.

Stand 9 differs appreciably from the other two hardwood stands. The probable reasons for this are (1) the surface soil is very sandy which would permit more rapid oxidation of the organic matter, and (2) the leaf fall in stand 9 consists of about 60 percent oak leaves as compared with 15 percent for stands 7 and 8. That oak leaves have a slight dry matter loss with time when compared with other hardwoods (Dogwood, red maple, hickory, etc.) has been shown experimentally by Lunt. That the oak leaves are slower to decompose is also shown by the fact that in stand 9 the humus type is a duff-mull (H-layer present) while in stands 7 and 8 the humus type are mulls (no H-layer present).

This study shows us the probable range of organic matter content of Piedmont forest soil, i.e., from young pine planted on abandoned and eroded fields to old growth hardwoods growing on soil that has not been cropped for at least 150 years.

In the near future it is expected that more samples will be taken in other forest stands so that the contribution of the numerous variables can be more accurately described.

Samples were collected during the quarter at the Santee Experimental Forest to determine organic matter levels on the control, and the winter and summer burned plots.

Advisory Committee Meeting

The first meeting of the Piedmont Advisory Committee was held on June 25-26. The weatherman cooperated by bringing 105° temperatures both days but otherwise the meeting was stimulating and we received many valuable suggestions. Committee members present were:

W. J. Barker	C. H. Flory
C. J. Blades	J. F. Lutz
F. H. Claridge	T. E. Maki
J. J. Ennis	R. J. Riebold

Others present were C. E. Ostrom, G. H. Hepting, W. A. Campbell, Thomas Lotti, and E. V. Brender.

General

Metz led a discussion and field trip to show methods of site determination from soil characteristics at the annual meeting of the South Carolina State Forestry Group.

Hoover attended the American Geophysical Union meeting in Washington where he discussed a paper by A. S. Fry of the T.V.A. entitled "Effect of reforestation and erosion control upon hydrologic characteristics of Henderson County watershed." Within a year, after building check dams, diversion ditches and planting trees, the T.V.A. found that flood peaks and sediment production were greatly reduced. It is possible that in the southeast, at least, we have been too conservative in our estimates of the time that must elapse before watershed improvement programs will bring results.

Publications

Hoover, Marvin D., Water and Timber Management. Jour. Soil and Water Conservation 7(2):75-78. April 1952.

QUARTERLY REPORT
Flood Control Surveys
Southern Forest Experiment Station

April - June 1952

Flood Control Surveys

While much of the flood survey work went forward approximately on schedule, little progress was made in regaining ground lost in recent months due to loss of personnel and other continuing difficulties. Most of the effort was on bringing the Ouachita and Lower White survey information to a stage where the needs of the Arkansas-White-Red Basin study can be met, at least tentatively. A substantial amount of field work was accomplished on the Hatchie-Loosahatchie-Wolf survey, and some sizable contributions made to forestry phases of going SCS survey projects.

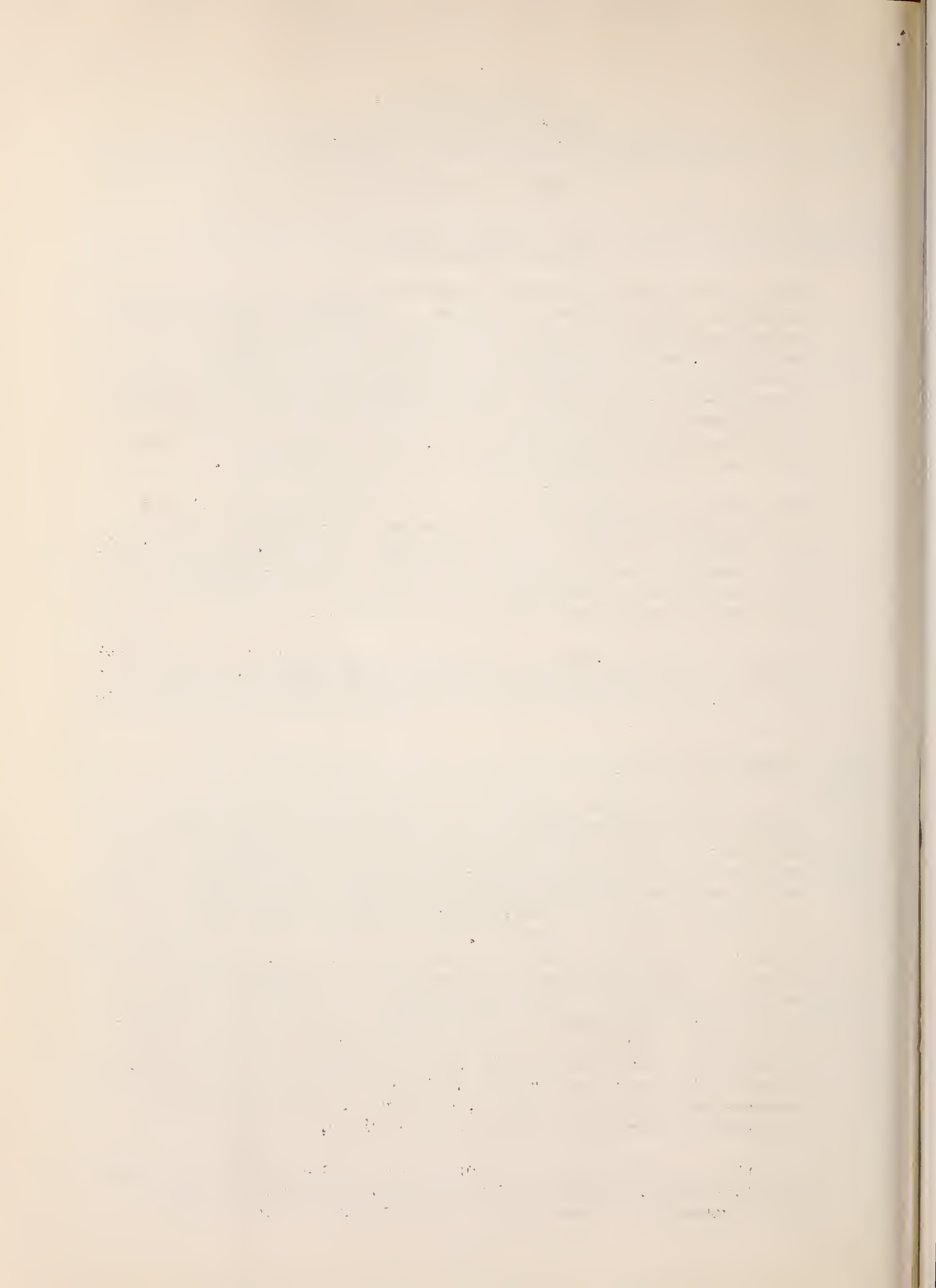
Stephenson has been designated to head up the Cumberland River Basin study which is to be headquartered in Nashville and is to get under way in July. As Forest Service leader, Stephenson will be responsible for flood survey activities in the Basin, and as the Department representative will supply leadership for the comprehensive agricultural phases of the study.

Richard W. Wilke, formerly in flood surveys with the SCS Milwaukee office, is transferring from the Upper Michigan Forest in Region 9 to a hydrologist position at the Southern Station. He will report in early July.

Current Surveys

After forwarding the Ouachita "possible solutions" report to AWRBIAC agencies for study and use, additional effort on this project was limited to Davey's study of ways and means of improving the unfavorable cost-benefit ratio for the openland phase of the recommended program. The rather unfavorable showing for the openland program is due principally to the very conservative estimate of on-site benefits. Since these are based on or consistent with AWR team estimates of yields, etc., the tentative Ouachita calculations probably foretell similar results when the on-site benefits for other sub-watersheds are evaluated under AWR procedures. Discussions in New Orleans and Fort Worth have developed SCS suggestions to scale down fertilizer and lime applications to minimum levels rather than to up estimates of yield. The discussions have also revealed differing concepts as to flood control objectives and needs, and further discussions will be necessary to reconcile some of these views.

Work on the Lower White has progressed to the active program formulation stage, with much of the basic data assembled and most of the contacts with consulting agencies already out of the way.

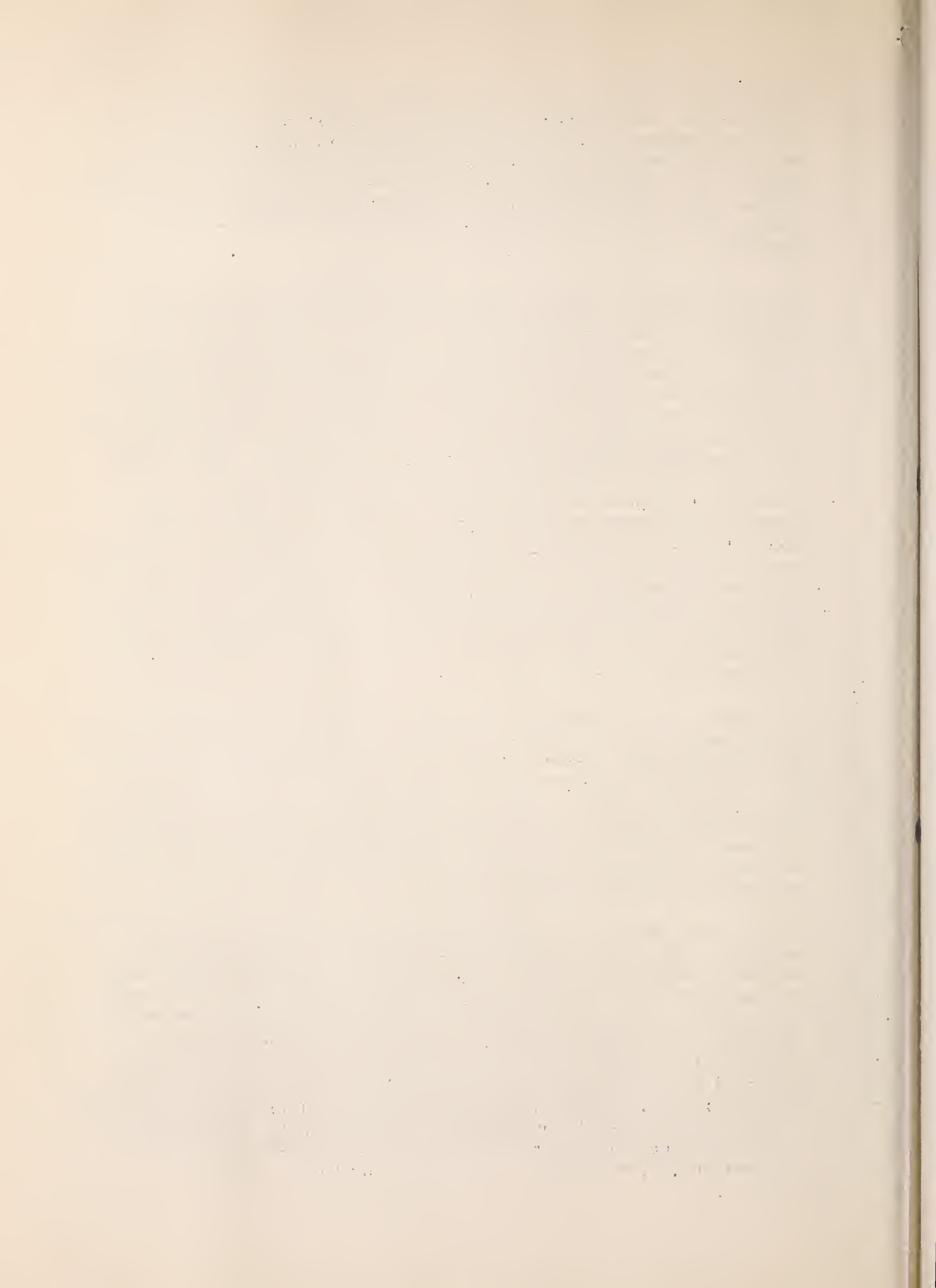


Discussions in this regard have been held with PMA, Extension Service, and the University people in Missouri and Arkansas. In this connection, Meginnis met in Jefferson City April 23 with State Forester White and Assistant Regional Forester Svensen of Region 9 to discuss public acquisition needs in the Missouri portion of the Lower White River Basin. Spector also obtained data for program planning in Arkansas from the State Forester's office, June 24.

The main lag in the Lower White work continues to be the damage-hydrology studies. Utmost effort will be required to complete estimates of flood damages by late July, some of which will be tentative and subject to reworking and strengthening next fiscal year. Watershed treatment "possible solution" proposals, together with estimates of costs and benefits, probably will not be available until some time in September. Of highest priority is completion of the long-pending study of small detention reservoir needs in the Cane Creek-Little Black River watershed in Missouri. All efforts to obtain help on this have been unavailing until recently, when advantage was taken of cooperative assistance extended by the Missouri Water Resources Division. A meeting was held in New Orleans May 5 - 6 with the Missouri people to review data and the work accomplished to date on this study. The outcome was a decision to turn over part of the appraisal job to the State people for handling. The Station will collaborate on this as needed and will proceed with other phases of the investigation which is concerned with selecting the best system of detentions and assessing hydrologic effects.

Reinhart, of the Vicksburg Infiltration Project, was detailed to a one-month study of channel protection needs and techniques in the Lower White Basin. After several days of orientation in the New Orleans office, Reinhart spent about one week with Davey in the field observing types of channel scour and land damage as mapped in FCS field surveys, and studying the rather limited local efforts to remedy this. Additional work, drawing on technical services of engineers and others, is planned for the months ahead in order to strengthen and round out this study.

In late June Meginnis spent several days in the field with Davey and other SCS people considering forest range problems in the Arkansas Ozarks. In parts of Arkansas and eastern Oklahoma, some rather large acreages of low-grade mountain lands have been bought up and fenced by well-heeled outside interests and used for woods grazing. Some fairly large-scale work is also under way in chemically spraying woodland to remove the trees and convert the areas to native grasses. Such developments pose special problems in formulating watershed treatment programs. As yet, there is little in the way of experience or results to indicate the potentialities, economic limitations, or watershed effects relating to such land use shifts and practices.



During May and June an engineering party from Spartanburg and FCS field men completed valley cross section surveys and floodplain mapping for sample reaches in the Hatchie-Loosahatchie-Wolf River watershed. In all, cross sections were obtained for about 80 main stream and minor tributary reaches, and floodplain use and land damages were mapped on a total of 210 reach samples.

Cooperation With Soil Conservation Service

Tofte and Langdon spent May 19 - 23 in Spartanburg and Atlanta obtaining basic information from Region 8 and the State Forester on current programs, forest ownership, and other data for the Coosa River watershed. Later (June 16 - 18), Stephenson and Tofte participated in a field reconnaissance of the Coosa area, accompanied by Stevens of the Regional office and Rast of SCS, to arrive at an estimate of public acquisition needs. The gross and net areas involved in indicated purchase units are being compiled, and recommendations will be submitted soon to Region 8 for review and suggestions.

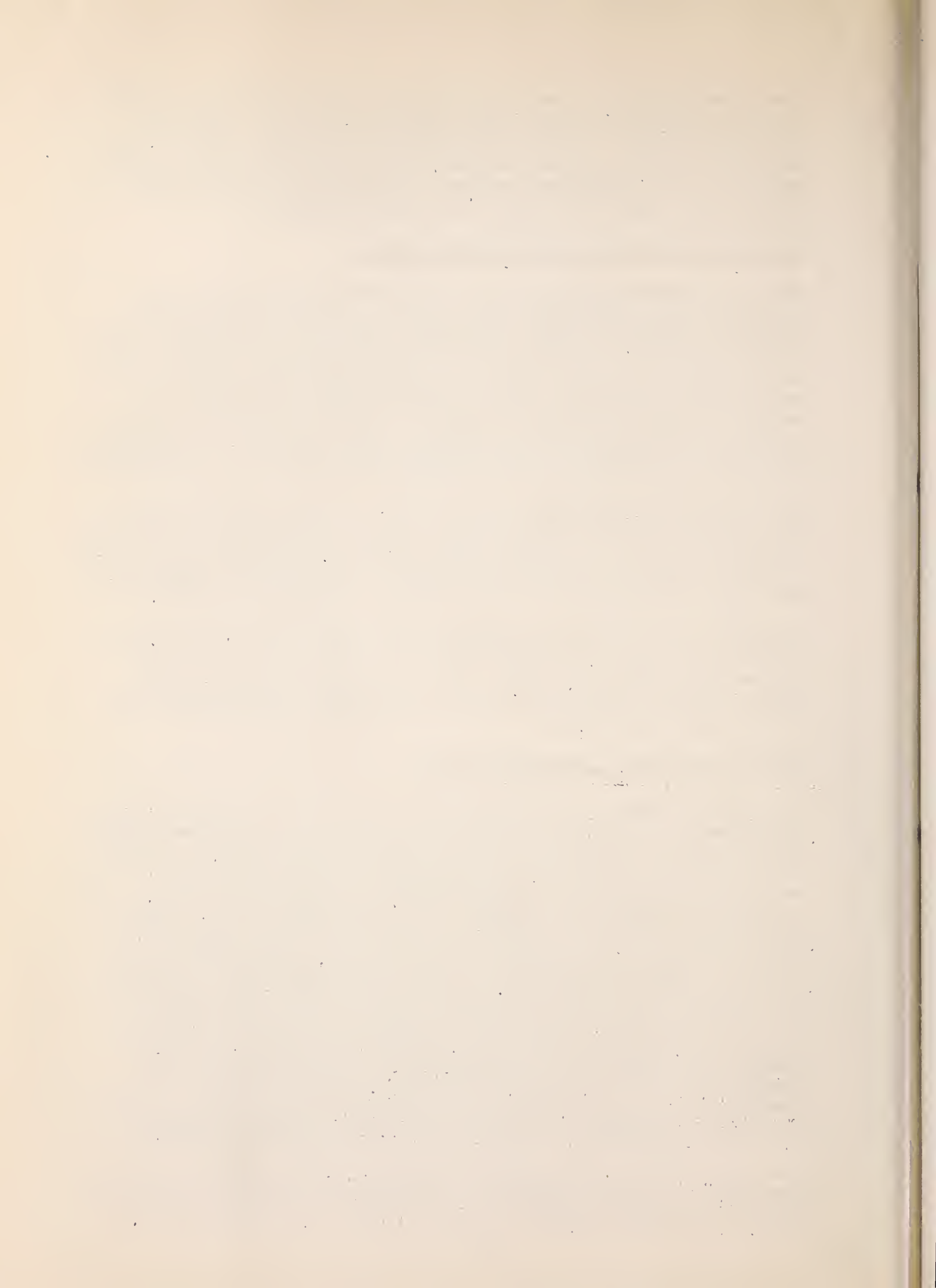
Most of the FS contributions to the Red River survey were completed and forwarded to Fort Worth in late June. Included was tabular and descriptive material covering forest conditions, recommended forestry measures, quantity and costs of measures, estimates of future forest hydrologic conditions, and calculated on-site woodland benefits.

Ferguson of the East Texas Branch was detailed to, and finished, a 6-weeks field survey of forest land hydrologic condition in the Sabine-Neches River watershed. This is the only Forest Service work to date on this project and the remaining contributions will be made next fiscal year.

Arkansas-White-Red Inter-Agency Study

The AWRBIAC effort is now approaching the "possible solution" stage preliminary to developing a tentative plan of improvement--due this coming winter. If the work is to keep on schedule, rather drastic measures are now indicated in coordinating project proposals for the so-called water functions--flood control, waterflow retardation, navigation, irrigation, drainage, and water supply. In a recent organization change, a special task force has been designated for each sub-basin, its job being to review and coordinate statements of need and proposed solutions. This arrangement largely by-passes the manifold work teams which were created to deal with each of these functions and it remains to be seen whether the new arrangement is a practical one and can accomplish the desired results. Meginnis has been named as the Department representative on the coordination team for the White and Ouachita River Basins. A formidable series of meetings has been scheduled for accomplishing this phase, beginning in mid-July and running through November.

Much work remains to be done in preparing for the possible solutions coordination job under AWRBIAC. A huge stack of Corps of Engineers possible solutions reports has been reviewed in the FCS Division,



and project proposals summarized for future reference. Flood damage and off-site benefits from watershed treatment will have to be itemized or broken out for special comparisons with other agency data or proposals. All of this will entail much work. It can now go forward for the Ouachita Basin, but must be deferred for the Lower White until estimates of flood control needs and program recommendations are available.

The USDA Field Committee is going ahead with plans for appraising benefits from agricultural and forestry programs to be included in the Basin plan. The procedure in many respects is patterned after that used in the flood surveys, but will use other source information to be supplied by the BAE. Stephenson, Davey, and others have spent considerable time acquainting members of the Tulsa group with evaluation procedures, and in making available estimates of yields, production costs, and other basic information.



Forest Influences Research - (Tallahatchie Branch)

A study of the soil-conditioning effects of "Kriliun" on young loblolly pine planted on adverse sites was installed in May near Oxford, Mississippi. Kriliun is the new, much publicized, soil conditioner recently developed by the Monsanto Chemical Company. It is especially recommended by its producers for treating soils of high clay content to make them more porous and friable.

The study includes five blocks all on relatively heavy clay subsoils typical of many hard gully bottoms and severely sheet eroded bare areas near the eastern edge of the brown loam area of north central Mississippi. Site conditions among the blocks range from poor to extremely adverse. Each block includes four treatment plots: (1) Kriliun (formulation #6); (2) Kriliun (formulation #9, a finer and more hygroscopic form); (3) cultivated without addition of Kriliun; and (4) no treatment (check).

Kriliun was applied at a rate of one pound per 100 square feet of surface and thoroughly mixed to a depth of three inches. This resulted in a Kriliun concentration in the top three inches of about 0.04 percent of the weight of soil.

A report on comparative survival and growth of the loblolly pine planted on these areas will be prepared this fall.

QUARTERLY REPORT
Division of Forest Influences
April-June 1952
Southwestern Forest and Range Experiment Station

On May 26 Dr. H. G. Wilm, Chief of Division of Forest Influences Research, Bert Lexen, Assistant Chief, Division of Forest Management Research, representatives of the Intermountain, California, Rocky Mountain, Pacific Northwest, and Southwestern stations, BPIS&AE, Region 3, and Tonto National Forest met at Sierra Ancha Experimental Forest to consider a proposal for initiating a treatment program on three pine-fir watersheds in the Workman Creek area.

Dr. Wilm acted as chairman of the meeting and Director Price outlined the objectives and explained the purpose of the conference. After a short briefing of the existing conditions and their relation to the Southwest, the group took a trip over the watersheds to consider the problems involved. Through group discussion and redundant maneuvering, a suggested plan for treating the watersheds was agreed upon.

Three watersheds are available for treatment

Two watersheds are to be treated and the other held as a climatic check or control watershed. One watershed is to be treated from a purely hydrologic standpoint. The timber will be cut and left where it falls so that the effect of timber cutting can be separated from the effect of logging and road building on water and sediment yields. The vegetation will be removed in four stages, starting with removal of alders and maples, which have their feet directly in the water; next will be the cutting of the channel-bottom vegetation which receives additional water during the growing season; third will be the cutting of the timber from the moist soil sites; and the final cut will be to remove all remaining vegetation.

The other treated watershed will be used to test the effect of current management and timber harvest practices on water, wood, and sediment. Silvicultural practices such as mistletoe control, thinning to favor ponderosa pine, removal of oak, and the thinning of dense pole stands will be employed. The first cut will remove approximately 35 percent of the merchantable stand, rid the area of oak, cut mistletoe-infected trees, and favor the production of ponderosa pine. The next cut in probably 10 or 15 years will be an improvement cut, taking 25 percent of the remaining merchantable volume plus the necessary improvement cuttings. The main objective of the treatment in South Fork will be to get the maximum yield of water and attempt to pay for it by a high degree of wood production.

It was the consensus of the group that the above design was logical and efficient and that the data collected from such a study would warrant the investment needed to answer some of the problems in the Southwest pertaining to ways of increasing water yields and decreasing sediment.

Conversion of chaparral to grass to be studied

Ten years of moderate and heavy grazing treatment on two small watersheds (9 to 15 acres) on which the cover is approximately 20 percent grass and 80 percent chaparral type shrubs has failed to change the water-yield picture when compared to yields from two adjacent watersheds which have been continuously protected from grazing. Three analyses of covariance made by comparing pretreatment periods and treatment periods (1) between the overgrazed and ungrazed watersheds, (2) between the moderately grazed and the ungrazed watersheds, and (3) between the moderately grazed and the overgrazed watersheds, did not bring out any real differences between treatment and pretreatment periods. From this it seems logical to conclude that neither moderate grazing nor overgrazing and the corresponding plant changes significantly increased or decreased total water yield. The reason for the lack of significant differences in water yield during the grazing treatments was probably due to the fact that (1) the weirs measure only the total water yield (the summation of surface and subsurface runoff); (2) grasses, which make up only 20 percent of the vegetation cover, grow mainly during the summer period and do not use water during the winter period when 89 percent of the water is discharged from the watersheds; (3) shrub types comprise 80 percent of the vegetation. Grazing apparently has not been sufficiently intense to greatly influence the protection given the watershed by this chaparral cover.

In order to further reduce the effect of chaparral influence, it is planned to cut and poison the shrubs on one watershed. In addition to the shrub-poisoning treatments, a mixture of perennial grasses will be seeded on the watershed to determine the effect of increasing grass cover when compared to shrub cover on water and sediment. Before actual application of this practice on a watershed basis, it is planned to first test the effects of poisoning and grass reseeding on a plot basis.

Infiltrometer studies are to be conducted in the Upper Rio Grande area

A Rocky Mountain infiltrometer has been constructed and is now ready for calibration. This infiltrometer is to be used in testing the effectiveness and values of range reseeding areas in the woodland and sagebrush types to determine the influence of reseeding on erosion and runoff. It is anticipated that these studies will be commenced by July 1.

Upper Rio Grande Research Center to cooperate with Department of Interior in conducting watershed studies

A field trip with Department of Interior personnel was conducted during May to select watersheds on the Rio Puerco for pilot studies to determine the effect of mechanical structures, mechanical land treatment, and vegetation treatment on water flow and sedimentation. The Rio Puerco watershed is one of the most deteriorated sub-basins in the Upper Rio Grande

drainage. It is estimated that between 40 and 50 percent of all sediment brought into the Middle Rio Grande Valley originated in the Rio Puerco drainage. Ten study watersheds were tentatively selected, six areas to be treated by the Bureau of Land Management and four by the Indian Service. These watersheds vary in size from 5 to 80 square miles. The watersheds were selected in pairs so that one may be treated and one left as a climatic control. There are still many details that need to be worked out before an adequate research program can be undertaken. It is anticipated, however, that many of the difficulties now encountered can be ironed out and considerable useful data will be obtained.

Dr. Wilm, Fletcher, Rich, and Dortignac spent the week following the Workman Creek conference looking over and reviewing forest-influences problems in the Salt River and Upper Rio Grande areas.



